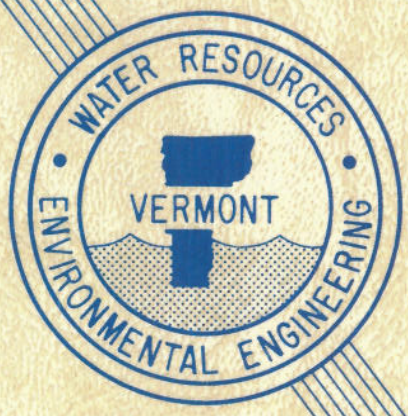
AGENCY OF ENVIRONMENTAL CONSERVATION

DEPARTMENT OF WATER RESOURCES

AND ENVIRONMENTAL ENGINEERING

WATER QUALITY DIVISION



prepared by
Vermont
Department
of
Water Resources
and
Environmental Engineering
Montpelier, Vt.

Conditional approval

Current 208 Program Summary and Proposed Work Plan for Completion of the 208 Program

June 24, 1981

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Part III Appendicies

Appendicies

A. Non Point Source Agricultural Runoff in the Lake Carmi Watershed - February 1981

B. Vermont Livestock Waste Management Educational Program

C. Guidelines for the Utilization and Disposal of Municipal Wastewater Sludge - February, 1981

D. River and Stream Bank Vegetation Management Policy

E. House Bill 360 - Minimum Streamflow

F. Interim Stormwater Management Policy

G. House Bill 402 - Stormwater

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I. Vermont Handbook for Soil Erosion and Sediment Control on Construction Sites. (separate)

PART I

Existing 208 Program
Summary

Table I. VERMONT 208 PROJECT SUMMARY

ription	Contractor	Budgeted	Spent	Obligated Unspent	Surplus (Deficit)	Contract signed	Scheduled Contract Completion	Interim Reports Received	Interim Reports Due	Comments
Rutland Regional Landfill Project	Rutland R.P.C.	20,770	13,050.00		7,720.00	9-78	10-30-79	1-79	FINAL	The contract expired on 10-31-80. The 208 Board voted to reallocate the balance of $7,720 to other 208 projects (see Table III).
Agricultural land for sludge	City of Burlington WPCF	5,000	4,500.00	500.00		5-8-78	4-79	7-78	FINAL	Submission of final report is overdue. The Secretary of AE(has written the Mayor of Burlington requesting final report 5-81.
Recreation Planning @ WWTF's	Phillips & Emberly	15,000	13,500.00	1,500.00		10-10-79	12-1-80	12-79	FINAL	Manual being edited; draft will be sent to EPA. Expecte completion by July 31, 1981.
Lay Monitoring Project	Dept. of Water Resources and Env. Engr.	16,500	10,694.23		5,805.77		complete	complete	✓complete	The State of Vermont has assumed support for this program; balance reallocated (see Table III).
Septage Education Program	Env. Engr.	7,000	0	7,000.00			(see comments)			The 208 Board approved this project prior to the May 28, 1981 meeting. A proposal is included for review.
Backroads Manual	Offset House	3,500	2,031.65		1,468.35	7-1-77	complete	complete	✓complete	Project is complete, reallo-cate balance (see Table III

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Recreation Planning 9 WWTF's	Phillips & Emberly	15,000	13,500.00	1,500.00		10-10-79	12-1-80	12-79	FINAL	Manual being edited; draft will be sent to EPA. Expect completion by July 31, 1981.
Lay Monitoring Project	Dept. of Water Resources and Env. Engr.	16,500	10,694.23		5,805.77		complete	complete	✓complete	The State of Vermont has assumed support for this program; balance reallocated (see Table III).
Septage Education Program IER	Env. Engr.	7,000	0	7,000.00			(see comments)			The 208 Board approved this project prior to the May 28 1981 meeting. A proposal i included for review.
Backroads Manual	Offset House	3,500	2,031.65		1,468.35	7-1-77	complete	complete	✓complete	Project is complete, reallo cate balance (see Table II

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cription	Contractor	Budgeted	Spent	Obligated Unspent	Surplus (Deficit)	Contract signed	Scheduled Contract Completion	Interim Reports Received	Interim Reports Due	Comments
Urban Storm Runoff	Dept. of Water Resources and Env. Engr.	47,500	43,188.68	4,311.32			12-79	12-29-80	FINAL	Final report is being edited; draft will be sent to EPA for review; Expected completion date July 31, 1981.
Sludge Project	Dept. of Water Resources and Env. Engr.	14,000	5,586.66	8,413.45			(see comments)			The first phase of the study is complete. Report being written and draft will be sent to EPA for review. Proposal is included for remaining funds (see Table II
Wetlands Project	Dept. of Water Resources and Env. Engr.	40,000	6,000.00	34,000.00		4-81	12-81		ALL	This project recently under way in April, 1981; progress reports to be sent to EPA. Expected completion 12-81.
Assimilative Capacity	Dept. of Water Resources	89,500	42,614.45	46,885.55			11-82	10-79	FINAL	Project is on-going; a proposal for project completion is included with this section.
NPS Forestry Strategy	R. Townshend etc.	2,000	2,157.25		(157.25)		complete	complete	complete	This project over-spent by $157.25. Reallocate $157.25 from "sources of funds for reallocation" to make up deficit. A slide-tape progra will be submitted for review as requested (see Table V).

VERMONT 208 PROJECT SUMMARY

scription	Contractor	Budgeted	Spent	Obligated Unspent	Surplus (Deficit)	Contract signed	Scheduled Contract Completion	Interim Reports Received	Interim Reports Due	Comments
NPS Trouble Shooter	SCS	25,000	1,058.44	23,941.56		2/80	3/82	5/80 6/80 3/81	monthly	This 2-year contract is progressing satisfactorily. Lake Carmi Plan is complete (enclosed). Work continuin on Lamoille River. Monthly progress reports will be sent to EPA for review.
NPS TV Spots and Manual	SCS	3,700		3,700						TV Spots are completed, Manual being drafted and will be sent to EPA for review. Expected completic September, 1981.
NPS Manure Management '80	Vt. Ext. Service	500	500				complete	complete	✓complete	
NPS Manure Management '79	Vt. Ext. Service	400	400				complete	complete	✓complete	
NPS Lake Parker	Orleans County NRCD	3,100	3,100				complete	complete	✓complete	
UVM Fertilizer Management Manual	Vt. Ext. Service	3,000	0	3,000						Project recently underway. Expected completion Octobe 1981.
Lake Eutrophication Analysis Procedure LEAP NPS	Dept. of Water	18,000	0	18,000						LEAP has conditional approval from EPA (see Tal II). A limited contract will be assigned to the author of the LEAP Prograi

VERMONT 208 PROJECT SUMMARY

cription	Contractor	Budgeted	Spent	Obligated Unspent	Surplus (Deficit)	Contract signed	Scheduled Contract Completion	Interim Reports Received	Interim Reports Due	Comments
NPS Livestock Education Program	UVM Ext. Service	34,992	4,374	30,548				4/81	FINAL	Project began this past winter, interim report received 4/81 will be forwarded to EPA. Expected completion December, 1981.
NPS Erosion Control Manual	Wagner, Heindel & Noyes	8,000	3,375	4,625						This manual was written and now in draft. Addition per request of Secretary of AEC Draft will be sent upon completion as requested.
Streambank Management Manual	Dept. of Water Resources	3,000	3,000							A proposal is included with this work plan.
Lake Morey	Dept. of Water Resources and Env. Engr.	21,400	8,500	12,900		7/80	8/82	Three	1 INTERIM 1 FINAL	Three contracts were awarde for this project; Dr. William Walker, Dr. Milt Ostrofsky, and Wagner, Heindel and Noyes. Total contract awards amount to $21,000. Reallocated $400 (see Table III).
Ground Water APZ	Dept. of Water Resources and Env. Engr.	115,100	10,000	105,100		1980	1983		ALL	Project recently underway, winter 1980-1981.
Ground Water Chittenden County ADP	David Tarbox USGS Resources and Env. Engr.	30,000	23,000	7,000		7/79	12/79	12/21/79 3/31/79 6/30/80 9/30/80	FINAL 12/31/80	Contract with Dave Tarbox is complete. Data must be edited and final report written. Project Coordina has left Vermont and the project has stalled in the

VERMONT 208 PROJECT SUMMARY

scription	Contractor	Budgeted	Spent	Obligated Unspent	Surplus (Deficit)	Contract signed	Scheduled Contract Completion	Interim Reports Received	Interim Reports Due	Comments
										in erim. New Hydrologist to be hired soon. Project to be extended to January 31, 1982.
On-Site Program (unallocated funds)	NONE	17,240			17,240					Reallocate $17,240 to on-site plan implementation laboratory support (see Table III).
On-Site Program Health Ordinance Survey	Vt. Assoc. Cons. Dists.	40,000	5,000	35,000			1983	Two	6 quarterly reports and FINAL	Project underway and on schedule.
On-Site Program Septic Tank Installers Workshop	Vt. Ext. Service	5,000	1,928.30	3,071.70		5/81	11/81	1 quarterly 1 FINAL		A new contract for the balance of work and funds written; project will be starting soon.
On-Site Program Research on Innovative On-Site Wastewater Disposal Systems	Dept. of Water Resources and Env. Engr.	40,000		40,000						An RFP has been drafted by Protection Division and is included in this work plan (see Table II).
On-Site Program Research on Adequacy of Groundwater Standards Governing on-site wastewater disposal	Dept. of Water Resources and Env. Engr.	10,000		10,000						An RFP combining this project with the Innovativ Systems project has been written (see Table II).

VERMONT 208 PROJECT SUMMARY

cription	Contractor	Budgeted	Spent	Obligated Unspent	Surplus (Deficit)	Contract signed	Scheduled Contract Completion	Interim Reports Received	Interim Reports Due	Comments
On-Site Program Printing of Rural Sewage Handbooks	Offset House	11,500	8,417.92	3,082.08	3,082.08		complete	complete	✓complete	$3,000 reallocated to LEAP. $82.08 reallocated to other 208 needs on May 28, 1981. See Table III.
Stream Flow Maintenance (Fishery Flow Needs Assessment)		27,000	20,147.71	6,852.29			9/81	Two	FINAL	First phase of study is completed and the report should be completed by 7/81; the second phase to further test this methodology will be completed this summer.
Minimum Stream Flow (7Q10)	Richard Downer	32,400	4,000	28,400		8/80	6/82	12/27/81	Two+ FINAL	Project is on-ging and on schedule.
TOTALS		710,102	237,124.29	437,818.76	+35,158.95					

PART I Existing 208 Program (continued)

Assimilative Capacity
Completion Schedule

Assimilative Capacity Studies

The following is the proposed budget of funds from the 208 program for Assimilative Capacity/Wasteload Allocation projects:

1.	One position with Chittenden County Regional Planning Commission (Grade 18)	
	Salary July 1, 1981-July 1, 1982	$16,200
	July 1, 1982-September, 1982	7,155
	Expenses (Travel/Training)	3,529
2.	Two part-time positions (3 months for summer monitoring)	
	July 1, 1981-September 1, 1981 Salary	$4,000
	Expenses	1,000
	Total	$5,000
	One part-time position (3 months for summer monitoring)	
	July 1, 1982-September 1, 1982 Salary	$2,000
	Expenses	500
	Total	$2,500
3.	Overtime for around-the-clock sampling and analysis	$ 500
4.	Laboratory costs	12,000
		$46,884

A detailed description of the budget items above follows:

1. One position at Chittenden County Regional Planning Commission

   Duties:
   - -set up local process where all affected dischargers can participate in wasteload allocations
   - -education of participating communities in assimilative capacity/wasteload allocations
   - -develop with communities of alternate wasteload allocations
   - -coordination with State and local agencies
   - -development of institutional arrangements for cost sharing of AWT if necessary
   - -help define economic and social implications of wasteload allocation
   - -preparing wasteload allocation reports and assistance in wasteload allocation meetings and hearings

2. Two part-time positions (3 months for summer monitoring) - 1981
   One part-time position (3 months for summer monitoring) - 1982

The intensive nature of assimilative capacity field studies require a monitoring and analysis effort far in excess of normal Department of Water Resources capabilities. These two summer employees will assist in assimilative capacity studies on the Hoosic and Walloomsac Rivers during the summer of 1981. It is projected that one position will be necessary for summer monitoring during the summer of 1982.

3. Overtime for around-the-clock sampling.

Because of the intensive nature of assimilative capacity sampling, the large number of samples in a very short time, and the need to complete analysis within a specific parameter's holding times, skilled personnel must work double shifts and weekends to complete the analysis. Ability to pay overtime enables us to complete the required analyses.

PART II

Final Work Plan For
The Vermont 208 Program

A. Projects Approved by the Vermont
208 Board prior to May 28, 1981

Table II. Vermont 208 Board Approved Projects
For EPA Review and Approval

Project/Responsible Department	Amount
1) On-Site Program, Conduct Research on Innovative On-Site Wastewater Disposal Systems Department of Water Resources and Environmental Engineering - Protection Division	$40,000.00
2) Research on the Adequacy of Vermont's Groundwater Regulatory Standards Governing On-Site Wastewater Disposal Department of Water Resources and Environmental Engineering - Protection Division	10,000.00
3) Septage Education Program Department of Water Resources and Environmental Engineering - Environmental Engineering Division	7,000.00
4) Sludge Analysis Project Department of Water Resources and Enviornmental Engineering - Environmental Engineering Division	8,413.45
5) Lake Eutrophication Analysis Procedure (LEAP) Department of Water Resources and Environmental Engineering - Water Quality Division - Lakes and Ponds Section*	18,000.00
6) Streambank Management Publication Department of Water Resources and Environmental Engineering - Water Quality Planning Section	3,000.00
Total Board Committment	$86,413.45

* conditionally approved by EPA; a proposal for this project has been reviewed therefore a proposal is not included in this work plan.

Project Proposals and RFP's

RFP for Elements Nine and Ten of the State Water Quality Management Plan for On-Site Wastewater Disposal - Research into Innovative On-Site Wastewater Disposal Systems; Research into Groundwater Regulations/Standards Governing On-Site Wastewater Disposal

REQUEST FOR PROPOSAL

TITLE: Performance of Innovative and Traditional On-Site Wastewater Disposal Systems for Effluent Renovation and Dispersal

Project Description:

This will be a primary data collection research project to be conducted by a qualified consultant working under the supervision of personnel from the Agency of Environmental Conservation. The task involves assessment of the comparative success of large scale innovative on-site wastewater disposal systems versus traditional in-ground septic systems installed in compliance with Part III Health Regulations. At the same time the study will collect hydraulic and chemical dispersion information in order to check the validity of commonly used models.

Purpose

The report resulting from this research project will satisfy plan elements nine and ten of the 208 On-Site Wastewater Disposal Plan: "innovative on-site systems" and researching" the adequacy of state groundwater regulatory standards governing on-site waste disposal." It is felt that the two plan elements can be combined into a single comprehensive project.

There has been persistent pressure on the Agency of Environmental Conservation to allow for large scale mound systems and so-called wedge systems. The Agency has been hesitant to approve of such systems due to the lack of information on the success of those systems for wastewater renovation prior to surface discharge or introduction to the groundwater system.

It's important that the usefulness and practicality of such systems be evaluated as they compare with properly functioning normal septic systems. A significant part of this evaluation will be measurement of the presence and attenuation of trace organics - a subject which has become a concern but about which there is little information.

The primary task is to evaluate the renovative capacity of large scale mound systems and wedge systems as compared with both large scale traditional leachfields and background groundwater quality. Groundwater (or surface water in some cases) downgradient of all systems will be monitored to be used for future modelling of wastewater disposal impact on surface water or existing and potential water supplies. In addition, groundwater mound data and information on hydraulics will be obtained.

Project Elements:

I. Scope of Project

The Protection Division, Agency of Environmental Conservation will contact and obtain permission for monitoring and testing to be done on three (each) of mound system, wedge system, and normal large septic system designed in accordance with Part III Health Regulations. Wedge systems used will have most wells already in place, but proposals should be written assuming that two additional wells per wedge site will need to be installed, and five monitoring wells at the three mounds and three normal systems. The contractor will be responsible for installing additional monitoring wells (and should construct them so they don't affect trace organic levels).

II. Water Quality Monitoring

Proposals submitted should assume a 12-month monitoring schedule during which all wells are sampled each month. During the first seven months only fecal coliform, NO_3, P and Cl will be sampled for. During the eighth month, samples will be taken for volatile organics. Samples indicating presence of organics will be analyzed first to identify the organics (Health Department G.C.M.S.). Subsequently each sample indicating the presence of organics will be analyzed on a Water Resources gas chromatograph for concentration measurement during the final four months. Sampling and preservation procedures to be used should be stipulated and should follow most recent EPA standards. Although analytical costs will not be the responsibility of the consultant it will be the consultants responsibility to take field measurements of pH, temperature, electrical conductivity and D.O. (for surface water).

III. Final Report

Proposals should discuss the format and specific content of a final report. This report should compare site specific information (hydraulics/hydrology, soils information, system design etc.) with chemical data. Site and system performance should be evaluated and an attempt should be made to separate the influence of dispersion and dilution from other factors which may be significant in removing contaminants from wastewater. Specific conclusions should be drawn about attenuation and movement of trace organics in the subsurface. Conclusions should also be made about the usefulness of arbitrary factors such as retention times in assuming the quality of an indirect discharge (to surface waters or a water supply).

The final report will be due December 1, 1982.

Proposals should include at least:

1. specific details should be incorporated in work plan organized by task and subtask. All procedures used should be explained with sources referenced.

2. Description of pertinent experience for all personnel to be used on the project.

3. Proposal budget (which cannot exceed absolute figure of $30,000); either

   a) cost plus expenses with estimated project figure and a "not to exceed" value or

   b) a final contract price, but including general cost breakdown.

Proposals will be evaluated on the basis of the following and in the following order of importance:

1. Completeness and specificity of proposal. Professionalism of the work plan.

2. Innovation coupled with the scientific validity of the approach.

3. Project cost and completeness of budget breakdown.

4. Background and prior experience of personnel.

5. Optional interview.

All proposals are due June 12, 1981. Please direct all questions to David Stoner, Protection Division, 828-3341.

Implementation

Results of this study will be used to modify the Health Regulations governing on-site wastewater disposal and determine the feasibility of wedge and mound systems or alternative on-site wastewater disposal systems including specific regulations.

Septage Education Program

208 SEPTAGE EDUCATION PROGRAM FOR TOWN OFFICIALS

I OBJECTIVES

The State 208 Board allocated money to "develop an educational program to inform town officials of their responsibilities on septage management and on regulations governing site selection and disposal." The Solid Waste Program is interested in developing a septage education program for town officials and haulers in Vermont.

The objectives of this program will be:

1) To make town officials aware of their responsibilities for septage management and disposal within their communities.

2) To provide an education program for town officials and septage haulers regarding proper septage management and disposal practices.

3) To help town officials with septage management and disposal decisions by providing technical information and assistance.

II WORK PLAN FOR IMPLEMENTATION OF OBJECTIVES

To achieve program objectives, the Solid Waste Section will complete the plan of work below:

1) Meet with town officials and haulers to increase awareness of their responsibilities for septage management. Since it is not practical to meet independantly with all towns, meetings will be conducted initially on a town by town basis as local interest is expressed.

A regional approach will be used as interest in septage disposal develops. Meetings with groups of towns and/or haulers can be arranged as the opportunity presents itself. Town officer training sessions, sponsored by the University of Vermont Extension Service, would provide a good forum on a regional basis. These sessions are held each year.

2) A short, concise, well illustrated and simply worded booklet on septage will be developed. This booklet should essentially be non-technical that is, geared toward the layperson.

The publication will be directed toward, 1) potential health hazards from improper septage treatment and disposal, and 2) environmentally acceptable treatment and disposal practices.

The booklet will be distributed to town officials and septage haulers. Copies will also be available to the general public.

3) Present septage disposal guidelines will be updated to conform with the most recent research and information. Draft guidelines will be circulated in the layperson and technical community for comment and review. Solid Waste Program personnel will meet with all interested towns to present the guidelines and answer questions.

4) Visuals and/or audio visuals dealing with septage management and disposal will be developed for public presentations. These visuals can be an effective tool in the septage education process.

5) A workshop will be conducted dealing with septage management and disposal. The workshop will be geared toward town officers and septage haulers.

The workshop shall be sponsored by the Solid Waste Program. Participating agencies and groups may include the UVM Extension Service, Soil Conservation Service, and the Vermont Water Resources Research Center. Experts in the field of septage management and disposal would be invited to participate.

6) Provide technical assistance, information, and support to town officials and septage haulers after other phases of the program are completed. This technical support will be directed toward developing environmentally sound and economical septage management programs which comply with applicable state and federal regulations.

III SCHEDULE FOR COMPLETING OBJECTIVES

The objectives outlined in Section II will be completed within the time limits specified below.

1) Meetings with town officials and haulers initiated in the summer of 1981.

2) Septage booklet in print by fall of 1981.

3) Septage disposal guidelines upgraded in conjunction with initiating town officers and haulers meetings and developing septage booklet.

4) Visuals and/or audio-visuals developed by late fall 1981 or mid winter 1982.

5) Workshop for town officers and septage haulers conducted during late winter or early spring of 1982.

IV PROGRAM BUDGET

Anticipated costs for the program are as follows:

1. Septage booklet (approx. 2500 copies)	$3,000.00
2. Visuals and/or audio visuals	2,000.00
3. Workshop	
a. mailing	400.00
b. facility rental	500.00
c. guest participant expense	350.00
d. miscellaneous	250.00
4. Miscellaneous expenses (travel, postage, supplies)	500.00
Total	$7,000.00

Sludge Analysis Program

208 Proposal-Municipal Wastewater Treatment Plant Sludge Study

Discussion

Municipal wastewater treatment plant sludge is a potential resource. It can be used as a soil amendment and plant fertilizer. The use of sewage sludge is becoming increasingly attractive as energy and consequently commercial fertilizer costs continue to escalate.

Land application of wastewater sludge, in a rural state like Vermont, offers the best alternative for sludge utilization. This practice is compatible with the climate, topography, soils and economy of the state. However, landspreading must be carried out in a manner that does not create a health hazard, nuisance, or adverse environmental impact.

A thorough site and soil evaluation and periodic monitoring can minimize the probability of health problems and/or negative environmental effects. In addition, sludges must be carefully analyzed for nutrients, heavy metals, and other suspected harmful organic or inorganic constituents.

A need exists to secure background information on the nutrient and heavy metal content of sewage sludges in Vermont. Industries and/or institutions contributing to the waste stream entering municipal plants should also be identified. Concentrations of suspected toxic materials should be determined. There is also a need to determine sludge quantities generated, storage capacity, and how treatment plants are presently disposing of sewage sludges.

Objectives

The objectives of the Municipal Wastewater Treatment Plant Sludge Study are:

1. Sludge stabilization processes for each treatment plant will be identified. That is, the process used to significantly reduce pathogens.

2. The amount of sludge generated/year and sludge storage facilities at each plant will be determined.

3. The existing practice of sludge utilization/disposal at each plant will be ascertained.

4. Landfilling and/or landspreading sites will be documented and located on maps.

5. Industrial and institutional users of all municipal wastewater treatment plants in Vermont will be identified.

6. Sludge from Vermont wastewater plants will be analyzed for nutrients and heavy metals.

7. Chemical analyses shall be performed on sludges suspected of containing high concentrations of volatile organic compounds.

Objectives Completed to Date

A municipal wastewater treatment plant inventory has been conducted to carry out the objectives as previously noted.

1. Identify industrial and institutional users of treatment plants in Vermont.

2. Identify the sludge stabilization process employed at each plant.

3. Determine the amount of sludge generated and sludge storage facilities at each plant.

4. Determine present methods used by each plant for sludge utilization or disposal.

The inventory process included visits to each treatment facility to obtain the necessary information. The purpose of the visits was to interview the plant operator and conduct an inspection of the sludge handling and disposal facilities.

It is important to identify and accurately locate existing sludge utilization or disposal sites used by municipal treatment plants. This information is absolutely necessary to evaluate the environmental impact on the areas where sludge is ultimately disposed of.

Although beyond the scope of this study; site and soil conditions would be determined and appropriate monitoring procedures employed. The site identification and location process is precursory to a viable sludge regulatory and management program.

After the inventory phase of the study was completed, representative samples of sludge were collected from treatment plants and analyzed for the following constituents:

a. Percent solids

b. Nutrients

   1) Total Kjeldahl Nitrogen
   2) Ammonium Nitrogen
   3) Nitrate Nitrogen
   4) Total Phosphorus
   5) Total Potassium

c. Heavy Metals

1) Copper
2) Cadmium
3) Zinc
4) Lead
5) Nickel

This analysis included 57 of the 80 plants in the state. Twelve to fifteen plants have aerated lagoons and generate sludge for disposal only every 10-15 years. Other plants have septic tank-soil absorption fields.

Additional chemical analysis will be performed on sewage sludges from certain plants in the state. These analyses include chromium, mercury, and silver in addition to those constituents listed above. The plants selected receive wastewater from machine shops, the tool and die industry, and metal fabricating plants. A progress report of work completed to date is included with this proposal.

Proposal

This proposal is to fund the final objective (objective 7) of the Municipal Wastewater Treatment Plant Sludge Study. As a result of theinformation obtained regarding industrial and institutional users, selected sewage sludges will be tested for suspected toxic organics. The specific testing will be limited to a GC/MS scan for volatile organic compounds. These organics will include degreasers (tri and tetra chloroethylene), benzene and chloroform (see attached memo).

Implementation of the results of this study will be accomplished through the State Guidelines for the Utilization and Disposal of Municipal Wastewater Sludge. See Appendix C. These guidelines outline both the disposal of sludge in certified disposal sites as well as agricultural application.

Project Schedule

1. Sampling of sewage sludge from the following plants suspected of receiving high concentrations of volatile organics will require two months. These plants include:

Barre City	St. Albans	Montpelier
Bennington	St. Johnsbury	Newport
Brattleboro	Shelburne #2	North Springfield
Burlington (Main)	Fair Haven	Springfield
Burlington (East)	Hartford	Vergennes
Randolph	Lyndonville	Windsor (Main)
Rutland	Middlebury	Winooski

2. Data compilation, analysis and report writing will be completed in eight months.

3. It is the intention of the Solid Waste Section that sampling begin July 5, 1981.

4. Final completion date is expected to be May 30, 1982.

Budget

The 208 Board allocated $14,000 to conduct this study and EPA has approved the sampling and analysis of nutrients and heavy metals phase. The total expended thus far has been $5,586.55, leaving a balance of $8,413.45 (see Table II). The budget for this remaining work is as follows:

Volatile Organic Compound Analysis-21 Plants (includes travel and supplies)	$2,000.00
Data Compilation, Analysis, Report Writing	$3,050.00
Publication (printing)	$3,000.00
Miscelaneous Expenses (overtime, etc.)	$ 363.45

MEMORANDUM

TO: Stan Corneille, Solid Waste Geologist

FROM: Gerald DiVincenzo, Hazardous Materials Specialist GD

DATE: December 29, 1980

SUBJ.: Land Application of Municipal Sludge

Testing sludges for metals and nutrients prior to land applications should be continued. Expanding this testing to organic compounds must be reserved to sludges for which the selective extraction procedures is applicable and to those parameters which will be indictative of a potential pollution problem.

The extraction procedure (EP) for inorganic and organic contaminents will work for municipal sludges. I suggest that the department limit its justing organic contaminents to those contaminents threatening groundwater. Unlike surface waters which are threatened by small concentrations of a large number of contaminents, groundwaters are threatened by those organic compounds, whose movement to groundwater is rapid and do not have those contaminents filtered by the soil. Unless an industry, whose effluent is on the treatment plant line, is known to produce a waste containing a particular organic contaminent. The initial testing should be limited to volatile organic compounds (VOC). Because of their mobility these VOC's are a major threat to groundwater and serve as an indicator of other pollution problems. A scan for VOC's by gas chromotography or gas chromotography/mass spectroscopy will provide analysis from which the department can make its managerial decision as to land application and/or needed additional testing. These analyses are relatively inexpensive and provide more useable information and analyses for any other class of organic compounds.

Quantitation of found organic contaminents is not clear cut. During the current absence of groundwater standards I would suggest that for quantitation we refer to water quality criteria documents available for surface water and transpose some of these numbers for quantitation regarding health hazards to threats from land application of municipal sludge to surrounding groundwater systems. On November 28th, 1980 EPA published water quality criteria documents which detail amounts of various organic compounds which would serve as a threat to both fresh water aquatic life, salt water aquatic life and human health. By researching the background documents which went into these criteria we could separate that part of the human health element which is attributed to the water itself. The numbers reached for each of these organic contaminents regarding human health was based on an adult daily intake of two liters of water plus a set 6.5 grain average of fish per day. The part attributed to eating fish will vary because of the intakes and bio-accumulation of each material in fish. This portion can be subtracted and that portion attributed to the water intake can be used to

evaluate groundwater for health hazards. Although the list of organic compounds for which criteria documents are available is not large, the volatile organics for which I feel we should be initially testing are addressed. There is a discussion of halogenated methanes, such as chloroform, degreasers, such as trichloroethylene and tetrachloroethylene, and benzene and various substitute benzenes. These compounds will be the bulk of the type of volatile organics we will be monitoring, and the Agency can make a good decision on whether to land apply a particular municipal sludge from these analyses.

208 Municipal Wastewater Treatment Plant Sludge Study

Progress Report June 1, 1981

The Solid Waste Program has completed most of the items specified in the objectives' section of the document titled "208 Proposal-Municipal Wastewater Treatment Plant Sludge Study". These items deal with the inventory and sludge analysis phase of the study and include: sludge stabilization processes, sludge quantities generated, and storage facilities at each plant; utilization/disposal practices; industrial users; location of landfilling or landspreading sites; and sludge analyses from Vermont wastewater treatment plants for nutrients and heavy metals.

Approximately 10,000 gallons of sludge is generated annually by Vermont wastewater treatment plants. About 62% of sewage sludge is applied to agricultural land. However, only a handful (22%) of plants analyze their sludge prior to landspreading and even fewer plants base land application rates on the sludge analysis.

Sewage sludge stabilization (processes to reduce pathogens) is primarily by aerobic digestion (47% of the wastewater plants). Twenty-seven percent of the plants have anaerobic digestors, 9% sand drying beds, and 17% <u>other</u> processes for reducing pathogens.

Sludge samples from 57 Vermont wastewater treatment facilities were collected in February and March, 1981 for nutrient and heavy metal analysis. Results have just been received and are included. Twenty-four (39%) of the plants sampled have heavy metals concentrations exceeding the United States Department of Agriculture suggested maximum limits for sewage sludge which is land applied. Copper is the metal exceeding suggested maximum concentration limits in 18 of the 24 plants. Other metals in excess of USDA limits are: lead-two plants, zinc-two plants; nickel-three plants.

Anaerobically digested sludge characteristically produces a more nutrient rich sludge than sludges produced by other methods to reduce pathogens. The information is now available to evaluate the nutrient content of Vermonts sludges compared to the processes employed to reduce pathogens. This information has not been compiled yet but is especially important since nitrogen will determine, for the most part, annual land application rates in Vermont.

Sludge metal analyses for mercury and silver are not available at this time. The wastewater treatment facilities selected for the additional metals are: Barre City, Bennington, Brattleboro, Burlington (Main), Burlington (Riverside), Hartford (W.R.J.), Lundonville, Rutland City, St. Albans, St. Johnsbury, Shelburne (#2), North Springfield, Springfield, Swanton, Windsor (Main), and Winooski.

In January, 1981 the Water Resources Laboratory contracted with the Solid Waste Division to perform a survey of the municipal wastewater treatment plant sludges. This project was undertaken to provide information concerning the composition of these sludges to the plant operators, involved farmers and to Solid Waste Division.

Sampling

The sampling for the 1981 sludge program began the week of February 23 and went on for six weeks. During this time 57 plants were sampled with ten true duplicate samples taken. Three of the 60 originally agreed-upon plants were not sampled: Proctor WWTF, because of missed connections with the operator, Johnson WWTF, because a flood the week before washed out the plant, and Colchester WWTF, because the digesters were shutdown for subsequent supernate drawoff. In general, secondary plants were sampled directly from the mixed aerobic digester, primary plants from the lowest tap possible on the secondary digester.

The sampling was accomplished in ten full days on the road, the majority of this time was because of the distances between plants. This is readily apparent in the Burlington and Montpelier-Barre areas where 11 and 9 plants, respectively, were sampled in one day vs. the northern and southern swings where 10 plants were sampled in two days.

Samples were collected into two containers, one was fixed immediately with concentrated H_2SO_4 and held on ice for the preservation of the nutrients, the others, for metals and solids, was iced immediately.

Analytical Methods

The day following arrival in the laboratory each sample for nitrogen and phosphorus was diluted by weighting a specific amount into a 100 ml volumetric flask and bringing up to volume with Nanopure water. This dilution was then analyzed the same day for ammonia nitrogen, total Kjeldahl nitrogen and nitrate-nitrite nitrogen. Within 2-3 days the dilution were analyzed for total phosphorus.

Samples for metals analysis were each digested by two methods. Approximately equal aliquots were placed in three beakers. Two beakers were digested using nitric acid and hydrogen peroxide. Analysis for metals was then performed on all three portions using a flame AA spectrophotometer.

Plant	TKN	NH_3	No_2-No_3	T-PO_4	%SOLIDS	K	Pb	Zn	Ni	Cu	Cd	Cr	N-P- K
ite River Jct. Hartford)	30.9	0.506	0.009	13.66	20.8%	1854	383	389	26.6	429	4.23	132	3.1/1.4/0
lder	21.3	1.24	≈.002	12.2	21.8%	1182	146	499	23.4	258	2.94	27.8	2.1/2.8/0
echee	25.7	2.51	0.092	62.5	0.76%	2560	76.4	400	12.4	3.58	3.58	159	2.6/14.3/
odstock (Main)	52.8	3.96	0.18	66.3	0.76%	10376	22.6	1040	22.3	765	4.44	46.3	5.3/15.2/
ftsville	41.4	0.22	0.12	45.8	0.72%	9628	990	1438	23.7	619	7.04	33.5	4.1/10.5/
th Woodstock	44.6	0.25	4.35	43.3	0.85%	6431	181	2150	33.0	889	5.89	43.9	4.9/9.9/0
low	37.9	1.70	0.0092	21.6	22.8%	1469	330	522	21.5	2396	3.02	34.8	3.8/4.9/0.
ndsor (Main)	29.8	1.14	0.0003	17.5	7.98%	1135	531	2604	45.1	735	9.57	55.0	3.0/4.0/0
nsor (Weston Hghts	52.5	0.169	0.298	27.3	0.59%	7777	57.4	521	17.4	267	5.22	22.8	5.2/6.2/0
ringfield	55.8	0.601	4.33	36.5	2.55%	9780	335	1098	64.8	957	6.5	102	6.0/8.4/1
th Springfield	61.2	0.50	1.70	21.8	0.40%	6770	119	308	15.7	645	3.51	37.9	6.3/5.0/0.
ster	51.2	0.261	0.165	16.5	2.30%	4410	189	400	19.0	1634	3.15	19.6	5.1/3.8/0.
lows Falls	9.84	1.502	0.042	5.24	7.17%	606	270	510	19.1	365	2.63	46.0	1.0/1.2/0.
ton River	69.6	6.58	0.004	23.20	1.14%	8402	303	637	25.4	657	9.21	48.0	7.0/5.3/1
ney	65.2	0.133	0.0058	21.3	1.20%	5881	110	673	21.3	515	3.37	33.6	6.5/4.9/0
attleboro	196.2	≈196	0.02	41.2	0.15%	18347	224	628	45.7	773	9.4	37.7	19.6/9.4/2
lmington	9.35	0.383	0.009	4.97	34.7%	895	401	540	23.0	304	4.24	32.3	0.94/1.1/0
st Dover	54.1	0.22	1.07	25.6	1.77%	5663	188	851	29.8	1165	2.67	39.3	5.5/5.9/0
nington	21.8	3.08	0.0014	13.4	3.63%	1345	1210	734	96.6	616	7.73	43.2	2.2/3.1/0.
tland City	16.7	2.79	0.0002	14.4	11.2%	7665	677	981	319	969	7.56	3.16	1.7/3.1/0.
ultney	59.2	1.12	0.346	20.8	0.66%	4838	213	819	18.3	1001	7.30	25.1	6.0/4.8/0.
rhaven	63.8	1.56	0.0034	21.3	0.80%	5912	175	489	14.7	783	5.87	17.0	6.4/4.9/0.
stleton	53.2	2.8	.0024	51.9	2.55%	5611	188	514	30.9	1050	7.87	130	5.3/11.9/0
st Rutland	63.9	16.2	0.0036	24.8	1.90%	4603	208	781	18.0	1308	4.10	26.9	6.4/5.7/0.
llingford	63.2	5.68	0.047	30.2	1.34%	3572	251	954	17.5	2178	4.49	21.6	6.3/6.9/0.
nter Rutland	18.8	4.55	0.0008	7.48	8.99%	1274	174	555	14.0	671	2.75	16.4	1.9/1.7/0.
ttsford	47.8	2.30	26.9	37.5	0.20%	13311	165	1020	26.6	761	5.05	37.0	7.5/8.6/1.
andon	53.8	0.520	4.44	32.0	1.24%	3544	225	858	25.0	656	7.18	35.0	5.8/7.3/0.
ddlebury	23.4	4.87	0.0067	30.8	10.5%	1134	383	1088	28.6	625	6.76	63.7	2.3/7.0/0.
we	45.0	0.103	4.45	32.6	2.72%	4814	230	809	72.3	1857	3.94	60.5	4.9/7.5/0.
risville	66.4	2.18	.0028	22.6	1.25%	7399	203	416	53.9	2490	2.70	55.2	6.6/5.2/0.
. Albans	24.7	1.70	0.0012	17.2	8.19	1312	894	1338	272	448	4.02	256	2.5/3.9/0
eldon Village	47.5	0.12	4.24	28.2	0.96%	4730	179	1496	44.6	448	4.07	35.8	5.2/6.5/0.
osburg Falls	39.4	0.79	0.004	26.0	1.82%	5321	300	689	467	382	1.82	62.0	3.9/6.0/0.

Plant	TKN	NH_3	No_2-No_3	T-PO_4	%SOLIDS	K	Pb	Zn	Ni	Cu	Cd	Cr	N-P- K
						mg. KG dry weight							
ewport	27.5	7.14	0.0028	10.9	1.09%	1691	291	594	68.5	380	4.65	87.6	2.8/2.5/0
orth Troy	56.2	4.11	12.3	28.9	1.60%	5107	255	1483	51.5	1207	4.25	25.3	6.8/6.6/0
yndonville	46.6	0.130	0,016	26.0	2.24%	6122	282	696	39.3	712	3.40	56.4	4.7/6.0/0
t. Johnsbury	12.3	2.11	0.0029	10.3	9.61%	2316	566	940	62.8	1349	5.78	127	1.2/2.4/0
helburne #2	59.0	4.27	0.0009	42.1	4.5%	3490	172	799	27.6	1861	3.94	19.6	5.9/9.6/0
helburne #1	75.4	0.20	1.58	50.9	1.23%	8411	82.5	658	17.6	1689	3.33	15.4	7.7/11.6/
outh Burlingtn													
artletts Bay	53.3	0.13	0.014	49.1	2.11%	5684	97	349	18.0	780	3.67	16.5	5.3/11.2/
urlington Main	56.4	26.2	0.0008	36.3	3.54%	2675	426	937	350	1342	4.79	387	5.6/8.3/0
urlington North	65.3	33.3	0.001	42.9	2.92%	2164	36.7	982	44.6	1678	4.36	74	6.5/9.8/0
urlington East	69.1	37.8	0.004	26.1	3.04%	2167	215	597	27.6	1877	6.43	10.6	6.9/6.0/0
inooski	52.6	4.83	0.002	36.0	2.79%	4330	126	530	35.2	699	2.67	27.3	5.3/8.2/0
outh Burlington													
irport Pkway	29.6	6.68	0.00008	25.3	8.95%	1340	315	1093	33.6	1170	7.95	42.3	3.0/5.8/0
ssex Junction	23.8	3.87	0.0003	22.5	5.91%	1331	283	834	26.3	945	4.00	66.0	2.4/5.1/
ichmond	101.8	36.8	.0034	46.2	1.05%	26528	48.2	206	7.61	224	3.2	11.4	10.2/10.6/
ontpelier	15.6	1.72	0.00019	10.0	18.8%	1409	315	622	23.8	559	4.77	55.9	1.6/2.3/0
orthfield	44.8	11.8	0.0019	20.1	1.88%	1827	343	1437	24.7	1308	3.56	50.2	4.5/4.6/0
andolph	48.5	0.818	0.0027	28.4	1.50%	6197	266	727	11.2	652	4.41	45.5	4.8/6.5/0
elsea	52.4	7.86	4.25	37.4	1.70%	5929	383	4160	9.8	851	6.88	47.2	5.7/8.6/0
radford	88.1	1.36	0.018	57.1	1.70%	8964	162	1049	33.0	739	2.98	29.6	8.8/13.1/
ast Barre	7.24	1.28	0.005	6.53	32.3%	392	110	352	23.4	154	17.0	17.0	0.7/1.5/0
arre City	38.3	2.24	0.0016	20.0	4.40%	4046	1028	808	16.8	502	6.51	40.5	3.8/4.6/0
erlin	54.0	1.01	0.0008	24.0	2.35%	6222	81	322	15.8	399	2.54	28.8	5.4/5.5/0
lainfield	59.4	0.52	0.031	26.4	1.91%	5978	116	821	11.0	562	4.38	27.0	5.9/6.0/0

DATA DISCUSSION

In general, the primary plant sludges were much thicker in solids content but much lower in nutrients. The overall mean nitrogen level, %N, was 5.0% while the mean for primary plants was 3.1% and for secondary plants the mean was 5.7%. The overall mean phosphorus level, %P as P_2O_5, was 6.4% with the primary plant mean being 3.6% and the secondary plant mean was 7.6%. For %K as K_2O, the overall mean was 0.60% with the primary plant mean at 0.31% and the secondary plant mean at 0.74%. This trend is due to the increased efficiency in waste capture by the secondary processes, and the smaller proportion of inorganic material and shorter digestion times in the aerobic digestion process.

In general, the heavy metals levels were not related to the type of process from which the sludge came. Nickel levels, chrome levels and, to a lesser extent, lead levels, were traceable to industries in the particular towns. There are 24 sludges which exceed the guidelines limiting maximum levels for application to agricultural land. Of these, 18 plants were over in copper only and another two plants in zinc only. Plants with elevated values or over-limits values are summarized in Table B. The Permits file provides some clues as to where these metals are coming from. Burlington Main plant has General Electric and Edlund Company which both plate nickel, Rutland City has Vermont Plating, Howe Richardson Scale Company and General Electric which all plate nickel and chromium and Union Carbide plates nickel and chromium in St. Albans. The lead levels in Bennington are in part due to the lead in the effluents of the Union Carbide, Globe Union and Catamount Dyers plants in that town.

Some of the elevated lead levels are explainable only as being due to supply piping. This would also be the case in the elevated zinc and copper values.

TABLE B

OVER-LIMITS OR ELEVATED METALS IN SLUDGES

Barre City		Pb	1028 mg/kg dry
Chelsea		Zn	4160 mg/kg dry
Burlington Main		Cu	1342 mg/kg dry
		Ni	350 mg/kg dry
Burlington North		Cu	1678 mg/kg dry
Burlington East		Cu	1877 mg/kg dry
South Burlington Airport Pkwy		Cu	1170 mg/kg dry
Shelburne F.D. #1		Cu	1689 mg/kg dry
Shelburne F.D. #2		Cu	1861 mg/kg dry
St. Johnsbury		Cu	1349 mg/kg dry
	Elevated	Pb	566 mg/kg dry
North Troy	Elevated	Zn	1483 mg/kg dry
		Cu	1207 mg/kg dry
Sheldon Village	Elevated	Zn	1496 mg/kg dry
St. Albans		Ni	272 mg/kg dry
	Elevated	Cr	256 mg/kg dry
Morrisville		Cu	2490 mg/kg dry
Stowe		Cu	1857 mg/kg dry
Wallingford		Cu	2178 mg/kg dry
West Rutland		Cu	1308 mg/kg dry
Castleton		Cu	1050 mg/kg dry
	Elevated	Cr	130 mg/kg dry
Poultney		Cu	1001 mg/kg dry
East Barre	Elevated	Cd	17 mg/kg dry

Rutland City	Ni	319 mg/kg dry
	Elevated Cr	316 mg/kg dry
	Elevated Pb	677 mg/kg dry
Dennington	Pb	1210 mg/kg dry
	Elevated Ni	96.6 mg/kg dry
West Dover	Cu	1165 mg/kg dry
Chester	Cu	1634 mg/kg dry
Springfield	Elevated Cr	102 mg/kg dry
South Woodstock	Elevated Zn	2150 mg/kg dry
Ludlow	Cu	2396 mg/kg dry
Taftsville	Elevated Pb	990 mg/kg dry
	Elevated Zn	1738 mg/kg dry
White River Junction (Hartford)	Elevated Cr	132 mg/kg dry
Northfield	Cu	1308 mg/kg dry

Streambank Management Policy
Publication

Streambank Management Policy

208 Program Project

After nearly five years of debate the Vermont Agency of Environmental Conservation has formulated a Management Policy for stream and river banks. (See Appendix D). Among the general objectives of the policy are the control of objectives which cause erosion and sedimentation and which lead to the water temperatures increase the late summer as a consequence of shade tree removal. A full description of the objectives can be found in the attached policy.

It is the objective of the project to summarize, illustrate, publish and to disseminate the policy as a brochure. The project will increase the general level of understanding of the importance of streambank vegetation. This project is extremely timely now in view of the increasing pressure on development on our streams and the increased cutting of easily accessible streambank trees for firewood. The thrust of the project will be to establish an atmosphere in Vermont which discourages the mismanagement of streambanks and which prescribes methods for enhancing their value.

Tasks	Cost	Schedule
Editing	1,200	September-October, 1981
Illustrations	300	October, 1981
Printing	1,500	November-December, 1981
	$3,000	

B. Funds for Reallocation (sources) and Proposed Projects Approved by the Vermont 208 Board on May 28, 1981

Table III Funds Available for Reallocation (sources)

Sources and Description	Amount
1) Lay Monitoring	$ 5,805.77
The 208 agreement for this project is complete and the remaining balance is $5,805.77. In 1980 the State of Vermont classified this position and supports it fully.	
2) Backroads Manual	$ 1,468.35
Remaining balance after project completion and printing.	
3) On-Site Program	$17,240.00
The State On-Site Plan was written after funds had been allocated by EPA for 208 on-site projects. In view of the developing plan, work on the projects funded by EPA was held up until the State On-Site Plan received approval. The final certified plan called for the expenditure of $17,240 less for projects than EPA had allocated previously.	
4) On-Site Rural Sewage Workbook Printing Balance	$ 82.08
Remaining balance after printing of the workbooks	
5) Lake Morey Project	$ 400.00
When the Lake Morey Project was funded the allocation was for $21,400, however total contracts awarded totaled $21,000.	
6) Rutland Regional Landfill Project	$ 7,720.00
The contract between the State of Vermont and Rutland Regional Planning Commission was signed in August 1978 and was to be completed a year later. The contract has twice been extended and was to be completed by October, 1980. A specific provision of the contract requires that the Rutland Planning Commission secure a certifiable landfill site which to date has not been accomplished. The acquisition of the landfill site is contingent upon completion of most of the contract. The outputs received for the $13,050 paid, the Commission does not fully document the accomplishments by the Rutland Planning Commission. These accomplishments include the establishment of the "Solid Waste District" and the awarding of an Urban Waste Grant which will provide future funding including landfill siting.	

	Amount
7) Administrative Budget Balance	$47,500.82

The administrative budget for the remainder of the 208 Program is presented in Table IV. Administrative funds originate from the percentage figured into a project award specifically for administration of the 208 Program. Future staffing requires the 208 Coordinator and a secretary. This reduction in staff results in the amount to be reallocated to other 208 needs.

Total Available Funds $80,217.02

Note: The sources of funds for reallocation received unanimous 208 Board approval on May 28, 1981.

Administrative Budget Analysis

Table IV.

Administrative Budget For Remainder of the 208 Program to September 30, 1982.

Item	Amount
Salary Requirements	$37,932.18*
Per Diem Board members-4 meetings	6,852.00
Office Supplies	150.00
Advertising	2,000.00
Freight & Express	100.00
Postage	60.00
Printing & Misc. Printing	2,000.00
Rental-Building other than office (Board meetings)	200.00
Office Rental	3,500.00
Copier Rental	200.00
Typewriter service contract	50.00
Telephone	400.00
In State Expenses	2,500.00
Out of State Expenses	2,500.00
Misc. Equipment	250.00
5% undetermined costs	2,834.71
Total projected Administrative Budget	$61,528.89

Administration Budget Balance (March 1981)	$116,729.71
+ temporary employees (set aside)	1,000.00
	117,729.71
- $1,700 transfer to LEAP	- 1,700.00
	116,029.71
- $7,000 printing and editing	- 7,000.00
	109,029.71
- projected administrative cost thru September 1982	- 61,528.89
Balance to be reallocated	$ 47,500.82

*The following assumptions were used to figure 208 salaries through September 30, 1982.

1) 1 208 coordinator

2) 1 secretary (note: only ½ of secretary's salary paid by 208, other half by 314

3) Weekly salary requirements

	Probation	July 5 1981 increase	End Probation	July 1982 Increase @ 10%
Coordinator	265.50	278.80	316.00[1]	347.60
Secretary	136.00	148.25	167.00[1]	183.70

[1]Projected new VSEA contract figures

4) Probationary Period. Coordinator completes probationary period (6 mo.) September 13, 1981, Secretary completes probationary period (1 year) February 1982.

5) Remainder 1981 Salary Requirement

a. Pay periods May 7 - July 16, 1981 (Probation)	$ 3,894.00
b. Pay periods July 30 - Sept. 24, 1981 July 5 increase	3,529.25
c. Pay periods Oct. 1 - Dec. 24, 1981 (Coordinator @ full rate)	5,461.75
d. Total	12,885.00
e. add 20% benefits	2,577.00
f. Total 1981 salary requirements	$15,462.00

6) 1982 Salary Requirements

a. Pay periods Jan. 7 - Feb. 18, 1982	$ 5,461.75
b. Pay periods March 4 - July 8, 1982 (Secretary @ full rate)	7,990.00
c. Pay periods July 22 - Sept. 30, 1982 (includes 10% increase)	5,273.40
d. Total	18,725.15
e. add 20% benefits	3,745.03
f. Total 1982 salary requirements	$22,470.18

7) Total salary requirement to completion of 208 Program

	$22,470.18
	15,462.00
	$37,932.18

**The following assumptions were used to figure 208 board expenses to the end of 208 functions September 30, 1982:

1) 24 Board members
2) Per Diem cost 1 member 1 meeting - $50.00
3) Average 100 miles average 1 member - 2400 miles
4) Projected number of remaining meetings - 4
5) Reimbursed mileage rate $0.195/mile - 1 meeting
6) Reimbursed mileage rate $0.220/mile (July 1) 3 meetings

Per Diem Costs	$4,800.00
Travel reimbursement (0.195)	468.00
Travel reimbursement (0.220)	1,584.00
TOTAL	$6,852.00

New 208 Projects
Approved by the 208 Board on May 28, 1981

Table V. List of Proposed Projects for EPA Aproval

Project		Allocation
1)	Hydroelectric Impoundment Modelling and Dam Operation Study	$36,500.00
2)	State Interim Stormwater Management Policy Analysis	$ 5,014.77
3)	Laboratory support for carrying out elements 9 and 10 of the State Water Quality Management Plan for On-Site Wastewater Disposal, State Interim Stormwater Management Policy Analysis, and Hydroelectric Impoundment Modelling which have a total cost of $91,514.77.	$27,325.00
4)	Lake Shore Management Guide	$ 6,500.00
5)	Dissemination of the 208 Construction Erosion Control Practices Manual	$ 3,720.00
6)	N.P.S. Forestry overrun* (see Table I)	$ 157.25
7)	208 Program Audit*	$ 1,000.00
	TOTAL	$80,217.02

$80,217.02

*These two items are self explanatory and no proposals or descriptions are required.

New Project Proposals

Hydroelectric Impoundment Modelling and Dam Operations Study

Hydroelectric Impoundment Modelling and Dam Operations Study

Discussion

Almost all of Vermont's major rivers and streams are regulated by hydroelectric plants (there are approximately 60 hydroelectric facilities presently operating). The Department of Water Resources and Environmental Engineering does not know how most existing hydroelectric dams are managed to release water and what the impact of such managed flow regimes may be on the impoundments and the streams below them.

During the Summer of 1981, the Vermont State Legislature will study a Minimum Streamflow Bill (see Appendix E) and its relationship to existing hydroelectric impoundments. The legislative investigations will address the environmental problems associated with hydroelectric dams and the best solutions to those problems.

Presently the 208 Program is funding two projects - the Streamflow Maintenance and Minimum Streamflow (7Q10) studies. The Streamflow Maintenance Study has as its goal the development of a methodology for assessing fishery flow needs on the streams below hydroelectric dams and to test this methodology on several proposed hydro projects. To date, this methodology has been developed and applied at 8 proposed sites. A report is currently being written and should be completed by July, 1981. The Minimum Streamflow (7Q10) Study has as its goal the determination of statistical projections of naturally occurring minimum streamflow of Vermont rivers and streams independent of hydroelectric dams. The statistical projections developed will be applied to proposed hydro sites for purposes of estimating low flow hydrology at that site.

Both the current studies address the methods of assessing environmental conditions at proposed facilities but do not address any of the following existing facility parameters such as leakage determinations; interrelationships of the environmental impacts on the river and impoundment from all hydro dams on the same river system; facility operation on a daily and seasonal basis; and site hydrology.

Proposed Project

This proposal is to fund a hydroelectric project which will consist of two phases to be carried out during the remainder of 1981 and the Summer of 1982. Briefly, the first phase proposes to assemble all existing data amd make site visits while the second phase proposes to construct an impoundment model to evaluate both existing and potential hydroelectric impoundments vis-a-vis State water quality parameters.

#2000-3000/site for existing survey
20hrs/site. #2000/site streamflow

Phase I proposes to:

1) Assemble all existing data on hydro dam operations such as peak and run-of-the-river flows and site hydrology from the Corps of Engineers, NERBC, PSB, etc .

2) Assemble maps of all existing hydro impoundments and dams.

3) Contact and interview utility officials with respect to dam operations and economics (KWH/CFS).

4) Make site visits to include: operator interviews; documentation of operating conditions; measurement of leakage flow during periods of impoundment, estimation of low flow (7Q10) hydrology; and identification of opportunities such as reservoir stability and river management.

5) Interview Fish and Game personnel and make assessments of the natural resources at each site.

6) Apply the fishery flow needs assessment methodology on at least two "critical" sites established by the Department of Water Resources and Environmental Engineering.

7) Make recommendations to the utilities for optimization of river flow. Estimate the cost of recommendations where possible using utility economic information previously gathered.

The second phase of the study proposes to construct on impoundment model to evaluate existing and potential hydroelectric projects vis-a-vis State water quality parameters such as dissolved oxygen (DO), turbidity, temperature, and phosphorus concentration.

Phase II proposes to:

1) Classify existing and proposed hydro impoundments according to such variables as watershed size, impoundment morphometry, existing water quality characteristics, fisheries and hydrologic factors such as water residence time and hydraulic loading.

2) Compile data base for existing reservoirs of interest and identify adverse water quality impacts. Compile data for proposed reservoirs with similar characteristics and identify adverse water quality impacts.

3) Review available literature on water quality of identified reservoirs and their associated impacts.

4) If available data is inadequate for modelling purposes develop and initiate a sampling program to collect water quality data on existing reservoirs.

5) Identify a modelling framework to assess water quality impacts associated with identified reservoirs.

6) Calibrate and test the developed model on existing and proposed hydro reservoirs.

Implementation of this study would be accomplished through the Minimum Streamflow Bill, support of FERC relicensing of existing hydro facilities, enforcement of Vermont Water Quality Standards, PSB certificates of public good, and developing economic and environmental agreements with utilities.

Time Schedule

Exact time/task statements cannot be made at this time except that the project will begin during the summer/fall of 1981 and be completed by December 1982.

Budget

An exact budget breakdown cannot be made at this time final work plans will require more time to prepare especially the time schedule and budget. It is hoped that the previous discussion will serve as grounds for acceptance of this project and accompanying laboratory services. As soon as a comprehensive work plan is developed it will be sent to EPA for review.

State Interim Stormwater Management Policy Analysis

State Interim Stormwater Management Policy Analysis

Discussion:

In 1978 a stormwater task force was organized to take an in-depth look into the literature on urban stormwater pollutants and develop a program to address the problem. The Vermont Urban Stormwater Program, the objectives of which are listed below was developed by the task force.

Vermont Urban Stormwater Program

I) Set forth the Interim Stormwater Management Policy (Appendix F attached) to abate the increase of stormwater pollution in Vermont. The interim policy is based upon the literature review and not actual studies in Vermont.

II) Evaluate paved areas subjected to diverse uses, i.e. shopping centers, high volume traffic areas, residential areas, fast food restaurants, motels, and gas stations to characterize the water quality of stormwater discharges and determine if the interim policy should require treatment based upon use or size or a combination thereof.

III) Evaluate a portion of the treatment systems installed as required by the interim stormwater management policy and determine treatment efficiency.

IV) Revise the Interim Stormwater Management Policy based upon completion of objectives two and three.

Presently, the 208 Program is funding the second objective of Vermont's Urban Stormwater Program. The final report is in draft and will be completed by the end of June.

Since the Agency of Environmental Conservation adopted the Interim Stormwater Management Policy, numerous sand filter treatment systems have been installed on new development projects in the State. The State does not have any information on the treatment efficiency of such systems or their maintenance needs. This information must be addressed prior to implementation of an Agency Stormwater Management Policy and for the Vermont legislature which will be reviewing a Stormwater Bill, H402. (see Appendix G).

Proposed Project

This proposal is to fund a project to address both the third and fourth objectives of Vermont's Urban Stormwater Program. We propose to evaluate the treatment efficiency and maintenance requirements of one sand filter system in the Burlington, Vermont area. Treatment efficiency will be determined on a mass balance

approach by comparing the loading of pollutants prior to filtration with the loading of pollutants after filtration as well as that which is by-passed. Results will be used to determine that portion of the runoff hydrograph which must be treated in order to achieve effluent characteristics compatable with Vermont Water Quality Standards.

Results from the stormwater characterization study (Objective II) and the treatment efficiency analysis (Objective III) will be utilized to recommend to the Water Resources Board the proposed revisions to and implementation of an Agency Stormwater Management Policy.

Monitoring

The previous stormwater study showed three parameters which exhibited high loadings regardless of the monitoring location. These parameters include COD, TSS and heavy metals (Fe, Zn, Pb, Mn). This proposed study will determine treatment efficiency based upon a mass balance approach using these parameters. Alternate parameters include BOD_5 (if determined not to be inhibited) and total phosphorus ($T\text{-}PO_4$).

Exact number of samples are unknown at this time, however, the sand filter as constructed pursuant to the Interim Policy will require three sampling points and a considerable amount of samples are expected.

Time Schedule

The proposed study will begin in the fall of 1981. One sand filter system will be instrumented and monitored for six weeks. The data will be analyzed and an interim progress report will be prepared.

During the spring and early summer of 1982, the same system will be monitored for four weeks. All data will be analyzed and the final report and recommendations to the Water Resources Board will be prepared. The project completion date is September 1, 1982.

Outputs: 1 interim report - January 1982
Final report and recommendations - September 1, 1982

Budget

Salary

1 temporary employee for data collection and analysis for 20 2eeks @ $175/week plus social security benefits.	$3,732.77
Overtime expenses	200.00
Miscellaneous supplies (reagents, site materials, etc.)	482.00
Travel and expenses	300.00
Report printing	300.00
TOTAL	$5,014.77

Laboratory Support for Carrying out Remaining Project Elements of the 208 Program

Laboratory Support for Carrying Out Remaining Project Elements of the 208 Program

Discussion

Environmental programs requesting analytical services have essentially doubled in the past two years without any increase in available laboratory resources. A major problem facing state programs has been the legislature's desire to maintain the current size of State government.

Laboratory Services has found it increasingly more difficult to support the existing programs and have actually been required to refuse request for services because of the lack of adequate resources. Surveillance and Analysis Division personnel of Region I, U.S. E.P.A. during their annual laboratory evaluation (1980) made specific comments regarding the need for upgrading analytical resources. Similarly, laboratory srevices was a State - EPA issue during 1980 in which the need for improved analytical resources was documented.

It is imperative that if approved 208 Program Projects requiring analytical services are to be integrated with existing programs, additional laboratory support for this project is mandatory.

On May 28, 1981 the Vermont 208 Board unanimously approved the Stormwater Management Policy Analysis; the Hydroelectric Impoundment Modelling and Dam Operations Study; and elements nine and ten of the State Water Quality Management Plan for On-Site Wastewater Disposal. These projects will require laboratory support for completion and the Board unanimously approved the laboratory support for these projects.

Proposal

This proposal is to allocate $27,325 in 208 funds for Water Resources Laboratory support services for completion of the previously mentioned projects. When final work plans and schedules are developed for the projects to be supported by the laboratory they will be sent to EPA for review and approval.

Lake Shore Management Planning Guide Publication

Lake Shore Management Planning Guide

Problem:

Vermont lakes are an important natural and recreational resource that must be protected. The lakeshore environment, which plays an important role in protecting the aesthetic and ecological integrity of a lake, is too often exploited as a result of recreational, agricultural, or industrial activities. The clearing of land, the installation of septic tanks, the construction of beaches, and the shoreland activities are all potentially damaging if undertaken without concern for the resulting impact on the lake. In many instances, the damage results not from a willful disregard by the lakeshore owner of the potential effects on the lake, but from a lack of knowledge concerning the ecological complexities of the lakeshore environment and the potential effects on the lake itself. To minimize damage from lakeshore activities, many local, State, and Federal laws or regulations exist which are designed to protect and appropriately utilize the shoreland resource.

At the present time there is no comprehensive program or resource available to educate the public in regard to lakeshore management techniques, laws and regulations relating to shoreland activities, or the ecological importance of the lakeshore environment.

Proposed Project:

This proposal is to fund a project which will develop a comprehensive booklet that will address the following aspects of lakeshore management on a non-technical level available to the general public.

1) Seasonal vs. year-round residences.
   a. Site planning
   b. Waste disposal alternatives

2) Management of the lake front for recreational activities
   a. Construction or alteration activities
   b. Controlling aquatic nuisances

3) Commercial activities in lakeshore areas
   a. Site planning
   b. non-point runoff/erosion control

4) Environmental Considerations
   a. value of the lakeshore environment
   b. potential environmental impacts

5) Laws and regulations relating to lakeshore activities
   a. requirements
   b. agencies responsible

BUDGET

costs:

1 temporary employee 16 weeks at $175/week	$2,800
Travel	500
Printing	3,000
Mailing	200
Total project cost	$6,500

output:

Publication entitled: How to Manage Your Lakeshore

Time Schedule

Task	Completion Date
Preliminary Research	August 14, 1981
Rough Draft	August 28, 1981
Draft Review	September 25, 1981
Printing	October 16, 1981

Dissemination of Erosion
Control Handbook

Vermont Erosion Control Handbook Dissemination Project

The 208 Program and the State Geologist have been working for three years to prepare a state erosion and sediment control manual for construction projects. The values of such a manual are many although a primary value lies in the fact that it will create a new context according to which contractors and designers will be expected to preform and by which state personnel will judge performance.

Although the manual is quite self explanatory it has already become evident that the creation of this new context of expectations will be greatly enhanced if the Agency conducts training sessions for both Agency personnel and for principle contractors, engineers, and architects throughout the state. The workshops will be designed to give the participants practice in the use of the manual's formulas for evaluating the erodability of a site and the use of erosion plan preparation techniques. We envision holding four workshops spaced throughout the state at appropriate locations. A copy of the manual currently in draft, may be found in the appendix. This draft does not contain the additional section requested by the Secretary of Environmental Conservation.

Tasks

Print workshop announcement flyers	200	December 1981 - January 1982
Conduct workshops contractual	3,000	February - March 1982
Supplies	520	December 1981 - March 1982
	$3,720	

PART III

APPENDICIES

Appendix A

Non-Point Source Agricultural Runoff in the Lake Carmi Watershed

February 1981

Appendix A

NON-POINT SOURCE AGRICULTURAL RUNOFF IN THE LAKE CARMI WATERSHED

FEBRUARY 1981

ACKNOWLEDGEMENTS

This report was prepared under the direction of the U.S.D.A. Soil Conservation Service and the Agency of Environmental Conservation, Department of Water Resources. Special thanks is given to the A.E.C., Department of Water Resources, the Franklin County Natural Resources Conservation District, the Town of Franklin and the Lake Carmi Association for their support of this study and in supplying needed data for this report.

I would also like to acknowledge the efforts put into this report by Allen Messier, District Manager, Franklin County Natural Resources Conservation District for his efforts in editing this report.

A technical report prepared by J. Eric Scherer, Water Quality Coordinator, Soil Conservation Service for the U.S.D.A.-SCS and the Vermont Agency of Environmental Conservation, Department of Water Resources.

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1. REPORT SUMMARY

Lake Carmi, located in the Town of Franklin, is a large, shallow, warm-water lake. The small drainage basin (7,020 acres) is approximately 53 percent woodland and 44 percent agricultural land. Water quality problems in Lake Carmi stem from untreated domestic wastes and non-point agricultural sources. Phosphorus is considered to be the limiting nutrient in the lake by the Department of Water Resources. Tests indicate an overabundance of the element for accelerated eutrophication (1). The lake is receiving much more phosphorus than it can assimilate without showing signs of accelerated eutrophication (1). It has been estimated that agricultural non-point pollution comprises 45% of the total phosphorus loading of Lake Carmi (2).

A watershed inventory of 30 landusers (88 percent of the total watershed acreage) identified 20 active dairy farms in Lake Carmi. The inventory also identified critical agricultural non-point and point sources problem areas. Some of the major areas of concern are: 1) Improper storage and spreading of animal wastes. Presently seventeen of twenty active dairies do not follow proper procedures for handling and disposal of wastes. There are approximately 1,560 animal units within the watershed that contribute 24,200 tons of manure annually; 2) Improper livestock operations and barnyard management. Fifteen operations are in need of milkhouse disposal systems and fourteen operations need a barnyard management system; 3) Improper Cropland Management Practices. Of the total 534 acres of cropland, only 66 acres are under a Conservation Cropping System. Use of the Universal Soil Loss Equation (13) on cropland shows a range of loss of 5 to 10 tons per acre per year with approximately 3,931 tons being lost yearly.

Recommendations concerning the abatement of agricultural water pollution in Lake Carmi include but are not limited to the installation of Best Management Practices (BMP's). Best Management Practices are land treatment measures applied to agricultural sources of water pollution. Some of the major BMP's recommended for the Lake Carmi Watershed are Animal Waste Management Systems, Waste Management Structures, Barnyard Management Systems and Conservation Cropping Systems. Best Management Practices have been identified in Water Quality Plans and have been generalized for this report on Table 2. The total cost estimate for the installation of BMP's to control agricultural pollution for Lake Carmi is $311,185. This breaks down into the three major areas: 1) $288,500 for proper manure storage and spreading practices; 2) $34,780 for proper livestock operations and barnyard management; 3) $47,555 for proper cropland management. Additional recommendations include: educational programs on agricultural related pollution and proper land management; monitoring of both lake resident camps and State Park facilities; and continued support of Department of Water Resources lake monitoring program.

With the data obtained from the Water Quality Plans and BMP's, coupled with the ongoing monitoring program of the Department of Water Resources, a more comprehensive picture of Lake Carmi can be obtained and an understanding of the extent, causes and hopefully solutions to agricultural related pollution can be formulated. This information shall prove valuable in ascertaining the impact of future programs aimed at improving water quality within Lake Carmi.

2. INTRODUCTION

The deteriorating level of water quality in Lake Carmi has been the object of growing concern by the lake residents, farmers and government agencies. Monitoring programs of water quality by the Agency of Environmental Conservation, Department of Water Resources (D.W.R.) has shown that the lake has become "highly enriched and moderately eutrophic" (5). Due to the growing concern with water quality degradation, D.W.R. had designated Lake Carmi as fourth in priority in the State for funding for long-term conservation practices to control non-point water pollution (6).

This report will provide the D.W.R. and other concerned groups the needed information on the sources and extent of agricultural non-point source pollution in the Lake Carmi Watershed. The data collected for this study is a result of visits with landusers and others concerned with water quality of the lake.

Information on land and lake resources, landusers, present farming activities, water quality problems and agricultural nutrient sources is provided in the report. The report makes recommendations as to needed Best Management Practices (BMP's) for the treatment of agricultural pollution in the watershed. Finally the report evaluates and documents costs of BMP's needed in solving water quality problems in Lake Carmi.

Location Map— Lake Carmi, Vt.

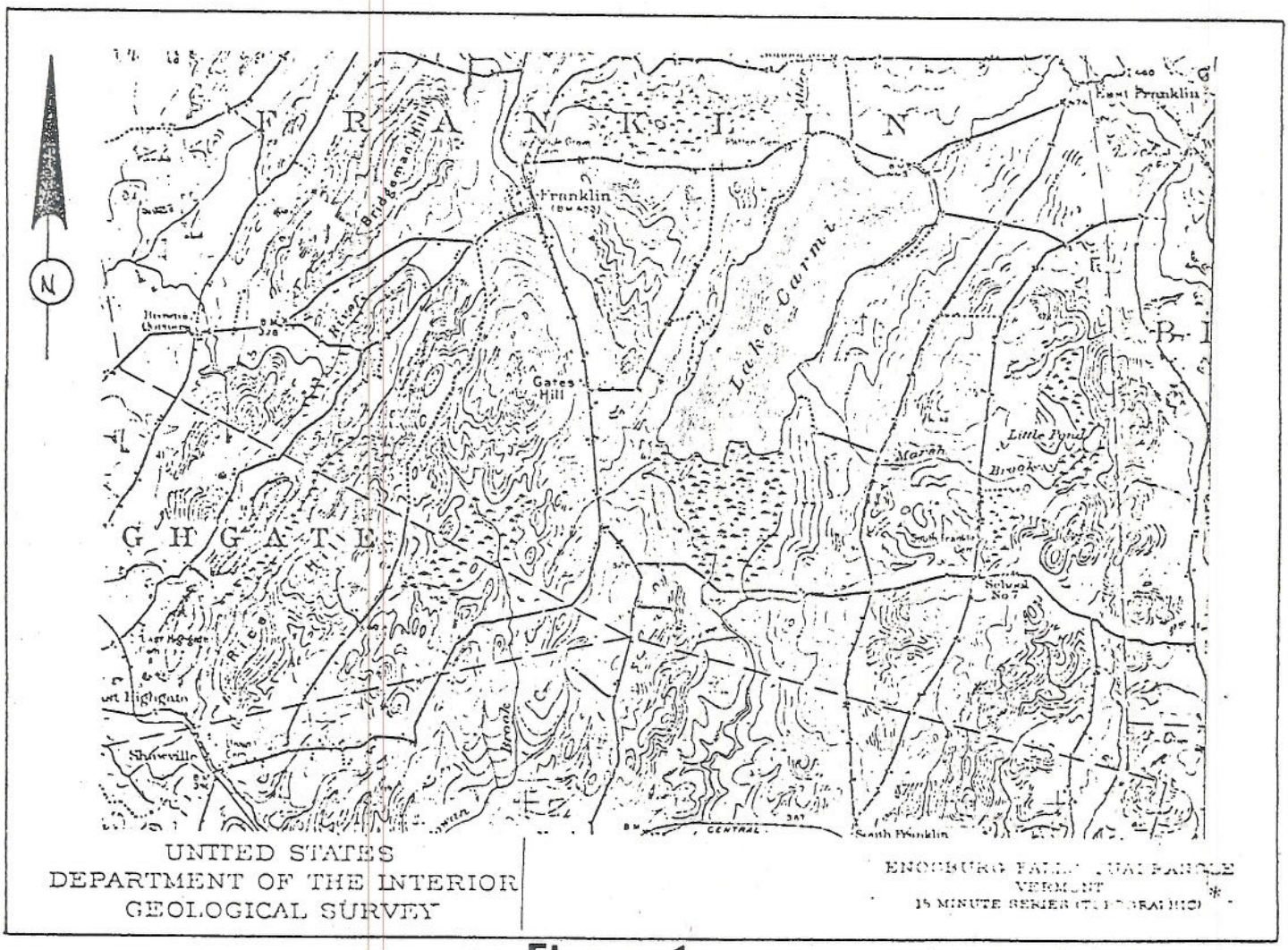


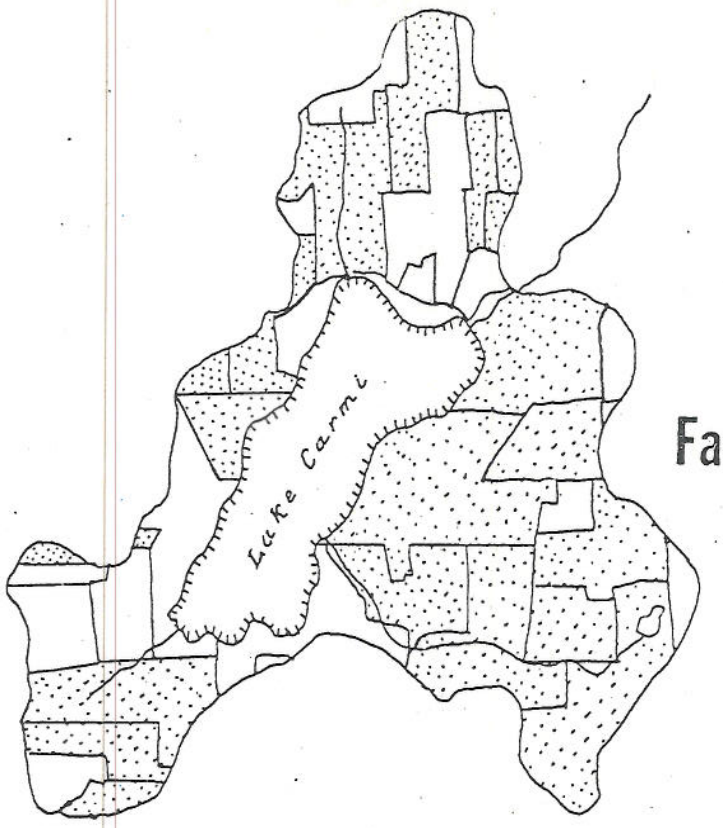
Figure 1 *(no scale)

3. ENVIRONMENTAL SETTING

Lake Carmi is located in the Town of Franklin, in Franklin County (See Figure 1). The lake is a large, shallow, warm-water body of water, covering 1,395 acres. It lies approximately three miles long and a mile wide. The average depth of the lake is 19 feet and its maximum depth is 33 feet. There are approximately 7.5 miles of shoreline. The drainage basin covers 8,020 acres including the lake surface area (1,395 acres).

General topography of the area is rolling hills with some slopes reaching 12 to 15 percent. Predominant soils surrounding Lake Carmi in low elevations and drainageways are: Carlisle Muck; moderately well and poorly drained Eldridge and Enosburg soils; somewhat poorly drained silty Binghamville and Birdsall. Upland soils developed from glacial till are: moderately well drained Stowe; somewhat poorly drained Peru and Westbury soils; and the poorly drained soils of Cabot. All of the soils have a dense, compact fragipan in the substrata. Tilled areas are relatively bare of stones, but pastures and wooded areas are very stony or extremely stony. Irregular to rough topography in the uplands have moderately deep Tunbridge and shallow Woodstock soils. They are associated with rock outcrops. These soils are well to excessively drained. Areas with few outcrops are in pasture, the more rocky areas are wooded.

Major surface water resources are comprised of Little Pond lying east of the lake on the Franklin-Berkshire town line. This pond gives rise to the major tributary Marsh Brook, which flows through mainly agricultural land entering the lake on the southeastern shore. Alder Run is the second major tributary to the lake, entering from the northwestern corner. Other surface waters enter the lake directly from the watershed (See Figure 4). It is also believed that some underground water enters the lake as the measured outflow of the lake does not equal the estimated inflow of surface water (7).

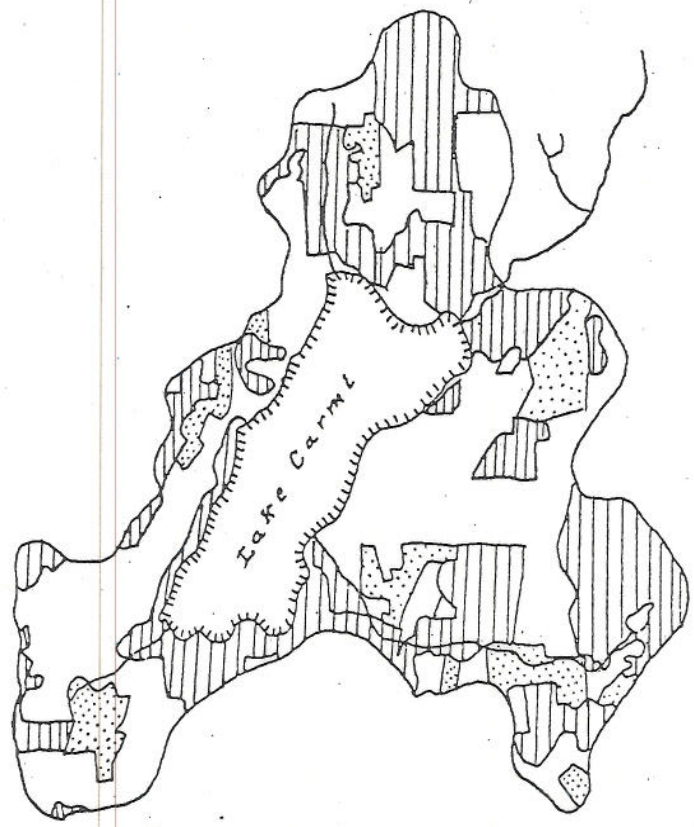


Farm Activity Map*

Active

Inactive

Figure 2



Land Use Map*

grassland

cropland

woodland

Figure 3

* no scale

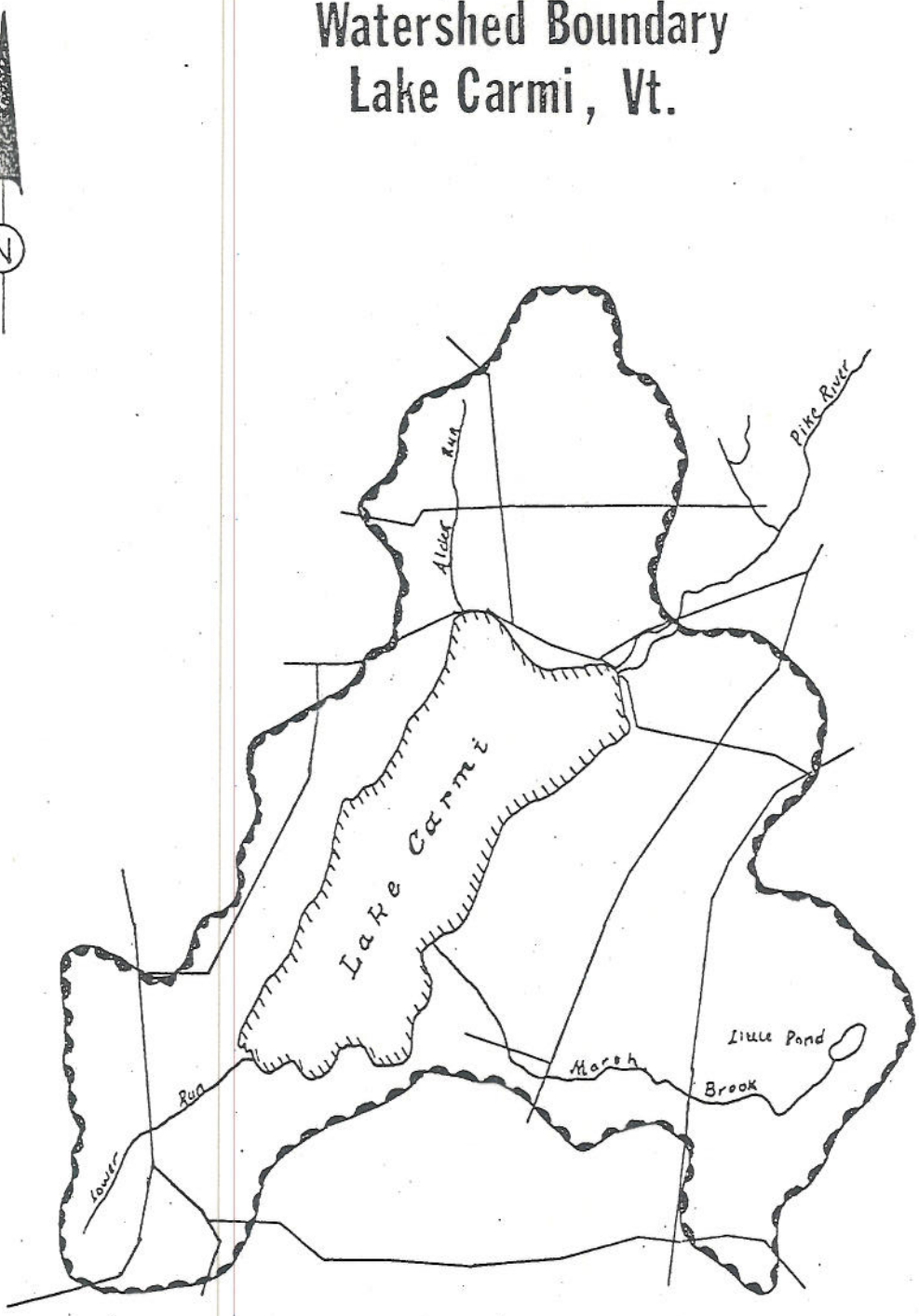
4. LANDUSER-RESOURCE INVENTORY

The Lake Carmi Watershed is composed of a rural population with recreation and agriculture as the major landusers. Recreational usage of the lake is high and seasonal. There are approximately 300 structures along or near the shoreline, used mainly as summer camps. In addition to private use, a public boat launch at the northern shore and a State Park on the eastern shore bring in additional users of the lake facilities. The State Park alone brought in 18,180 day and 36,207 overnight visitors (8). All of the lake is privately owned with the exception of the State Park. There are no main population centers in the watershed. Estimated year round population is 150.

In addition to the income brought into the area by recreation, the major industry of the watershed is still agriculture. A watershed inventory of 30 landusers (88 percent of the total acreage in the watershed) identified 20 active dairy farms, with one maintaining young stock only. The remaining 10 landusers include the State Park, private campgrounds and other inactive dairies (See Figure 2).

Of the total 5,881 acres inventoried in the watershed, 2,490 acres (42%) are woodland, 1,366 acres (23%) are pasture, 1,155 acres (20%) are permanent hay, 534 acres (9%) are cropland and 336 acres (6%) are recreational (See Figure 3).

Watershed Boundary
Lake Carmi, Vt.



Watershed

Lake

Road

(no scale)

Figure 4

5. WATER QUALITY PROBLEMS

The State Department of Water Resources has designated that the waters of Lake Carmi should be Class B waters (suitable for bathing and recreation, good fish habitat and aesthetic value). The agricultural portion of Vermont's Section 208 Water Quality Management Plan recommends Lake Carmi (along with Lake Parker) as fourth for priority for funding for long-term conservation practices for control and treatment of agricultural non-point source pollution. Water quality problems and its sources in Lake Carmi are not unique. The lake receives high levels of nutrients from untreated domestic wastes and non-point agricultural sources. According to the Department of Water Resources (4) present estimates of phosphorus loading to the lake (phosphorus being considered the limiting nutrient) is 45%, with 30% for forestland, 3% residential and 10% from subsurface sewage disposal.

Testing of phosphorus levels in the lake by the State Department of Water Resources indicated an overabundance of the element accelerated eutrophication (average. 029 mg/1) (10). Using a model to calculate the loading of phosphorus in the lake, the Department of Water Resources has shown that the lake is presently receiving much more phosphorus that it can assimilated (.015-.025 mg/1) without showing signs of accelerated eutrophication (10). Due to the shallow nature of the lake, it is possible that there is considerable recycling of nutrients from sediments of the lake and therefore figures for total loading of phosphorus to the lake may be underestimated (2). Measures of springtime total phosphorus loading indicate more than twice the critical loading rate of phosphorus without showing signs of accelerated eutrophication (2).

Additional data collected by the Department of Water Resources since 1965 shows the bacteriological water quality of Lake Carmi to be poor. Lake Carmi has the highest levels (in Vermont) of algal and chlorophyll concentrations. Algal populations are generally dominated by "blue-greens." (See Appendix B).

6. AGRICULTURAL NUTRIENT SOURCES

The State Department of Water Resources through their monitoring program, has pinpointed major areas of phosphorus loading to the lake. Data indicates Marsh Brook to have a great influence upon the total nutrient loading to the lake. A look at the land use map (Figure 3) will indicate a high level of agricultural activity along this tributary to the lake. The field survey conducted for this report identified and tabulated all non-point source pollution resulting from agricultural activity. A summary of this information can be found on Table 1 and below.

The contribution to the lake of phosphorus from agricultural segment has been placed at 45 percent of total loading (2). Agricultural non-point sources in Lake Carmi are principally the lack of proper animal and milkhouse waste management; lack of barnyard management; and improper cropland management. Erosion rates and soil loss from other non-point sources such as streambanks, road surfaces, roadbank and shoreline erosion have not been inventoried for the purpose of this report.

Animal Wastes from 1,560 animal units enter watercourses in the watershed. This amounts to 24,200 tons of manure annually entering the watershed system. Field surveys indicate that seven dairy operations spread manure daily in the winter and ten operations either stack it or have inadequate systems for storage of wastes during the winter months. Additional quantities of manure are inadequately managed during the rest of the year, for example: excessive applications; inappropriate applications on exposed steep slopes and easy access to watercourses; and stacking where runoff can reach surface waters directly. Fifteen of the twenty operations presently do not have adequate milkhouse wastes disposal methods. Barnyard Management Systems need to be installed on fourteen dairy operations. Pollution from barnyards occurs when clean offsite water enters the barn area and becomes polluted with wastes and also when wastes generated in the barnyard are allowed to leave area untreated and reach waterways to the lake.

Sediment also, compounds the pollution problem by transporting phosphorus to the lake. Presently 468 acres of cropland have no acceptable conservation cropping systems (systems that bring soil loss under allowable erosion rates using the Universal Soil Loss Equation). The range of soil loss is between 5 and 10 tons per acre per year with the total yearly loss being 3,951 tons. Although there are no exact figures on either streambank, roadbank or shoreline erosion, field observations indicate some occurrences (3).

7. RECOMMENDATIONS

The "Lake Carmi Water Quality Report 1976", State Department of Water Resources, has made several recommendations for action concerning the abatement of water pollution in Lake Carmi (12). They have addressed the agricultural inputs from non-point sources briefly. From the information obtained through the Department of Water Resource's Lake Carmi Report and this study, more detailed recommendations for the abatement of pollution from the agricultural segment can be made.

As a process of the field study for this report, Water Quality Plans were drafted and written for landusers. Of the 30 landusers inventoried 23 were in need of a plan. These plans identify and detail the needed Best Management Practices (BMP's for each non-point pollution source and area (See Appendix A for a description of the purpose of each BMP). Table 2 tabulates the needed BMP's for the control of agricultural pollution in the watershed. Costs for the estimated installation of each BMP has been calculated and also listed on Table 2. A discussion of these BMP's follows:

1) Of the 20 active farmers, all need a Waste Management System. This system would include but will not be limited to storage structures for both barn and milkhouse wastes. The System will also address waste utilization and specify rates of manure application within the range of the soils assimilative capacity for manure. This mangement system will alleviate the direct and indirect pollution of surface waters by timely and proper application of animal wastes.

2) Seventeen of the 20 active farms in the watershed need waste storage structures Storage will be for at least six months. Milkhouse wastes will be incorporated into 15 of these storage facilities. Proper storage of wastes will allow for better utilization of nutrients and eliminates the possibility of these nutrients entering the lake through surface runoff.

3) Included in the Waste Management System is the need for 14 Barnyard Management Systems. These management systems will control offsite water from entering contaminated areas and picking up pollutants. Also, systems would be designed to contain all wastes in barn area and direct them to storage facilities for proper handling. This system will aid in controlling pollution of surface waters from barnyard waste runoff.

4) Conservation Cropping Systems are needed on 468 acres of cropland. These systems will be in the form of crop rotations, stripcropping, diversion tile outlets, seeding of winter cover crops and conservation tillage. These systems will reduce the hazard of soil erosion and consequent pollution of surface waters. These systems will also be better able to utilize wastes applied to land by minimizing surface washing.

5) Other supportive BMP's that will aid in the retention of soil and consequently reduce non-point source pollution include: establishment of permanent vegetative cover; diversions; grazing land protection (aids in correcting streambank erosion); filter strips; grassed waterways systems; cropland protective systems. All of these BMP's improve water quality by providing needed protection from severe erosion on land and between cropping seasons or pending establishment of enduring protective vegetative cover.

6) Due to the limited logging activity in the watershed, no discussion of BMP's for logging operations has been discussed. Should the need arise in the future, the topic will be addressed separately with recommendations from the County Forester.

8. CONCLUDING REMARKS

The landuse status of the watershed is changing rapidly. At the time of writing this report, three landusers in the watershed have applied for Federal cost-sharing assistance for installation of Animal Waste Storage Facilities or Barnyard Management Systems. Additional systems installed in the watershed will decrease the magnitude of the existing problem. Also, of the inactive dairies in the watershed, there is a potential of reactivation of the four operations and one present active operation could subdivide into three active units.

According to the State of Vermont's "Water Quality Plan for Controlling Agricultural Pollution" (1), Lake Carmi (along with Lake Parker) has been ranked number four for priority in seeking funding for long-range conservation practices to abate agricultural pollution. The first three priority watersheds and Lake Parker have all had either measure plans implemented or drafted for agricultural pollution abatement. In the event of any future programs that would be designed to control agricultural pollution in Lake Carmi, an updated report may be needed to determine current needs as related to BMP's.

GLOSSARY OF TERMS

AGRICULTURAL POLLUTION - any agricultural related source of contamination that pollutes and degregates water quality.

ANIMAL UNIT - the equivalent of a 1,000-pound dairy cow.

BEST MANAGEMENT PRACTICES - land treatment measures applied to agricultural non-point sources and areas for the control of elements contributing to water pollution.

CONSERVATION CROPPING SYSTEM - growing crops in combination with needed cultural and management measures.

CROPLAND - land used primarily for the production of adapted, cultivated, close growing crops for harvest, alone or in association with sod crops.

EUTROPHICATION - process within a body of water in which the increase of mineral and organic nutrients has reduced the dissolved oxygen producing an environment that favors plant over animal life.

FORESTLAND - land on which the dominant plant growth is trees, and wood growth.

HAYLAND - land on which forage grasses are maintained and grown for at least one cutting of hay per year.

PASTURELAND - land on which forage and grasses are maintained for grazing.

WATERSHED - all of a land area whose surface water drains to a designated point.

WATER QUALITY PLAN - a recording of the landowner's or operator's decisions to treat critical water quality problem areas or sources through use of BMP's. The plan becomes a part of the water quality contract.

Table 1

NON-POINT SOURCE POLLUTION RESULTING FROM AGRICULTURAL ACTIVITIES

LAKE CARMI, VERMONT

I. IMPROPER MANURE STORAGE AND SPREADING PRACTICES		
Practice	Extent	Types of Problems
1) Stacking Manure in barnyards or fields near watercourses.	8 farms	Loss of soluable nutrients from manure into watercourses.
2) Inadequate storage Systems	2 farms	Need to spread earlier in spring or later in fall- loss of nutrients to watercourses.
3) Spreading of manure daily and/or on snow covered or frozen ground	7 farms	Loss of soluable nutrients from manure into watercourses.

II. IMPROPER LIVESTOCK OPERATIONS AND BARNYARD MANAGEMENT		
Practice	Extent	Types of Problems
1) Improper milkhouse, milk parlor waste disposal.	15 farms	Water pollution of streams due to inadequate disposal methods.
2) Barnyard Management	14 farms	Clean, off-site water entering barn area and becoming polluted entering watercourses.

III. IMPROPER CROPLAND MANAGEMENT PRACTICES		
Practice	Extent	Types of Problems
1) No conservation cropping system used.	468 acres	Soil loss and sedimentation of waterways; nutrient losses to waterways and pollution of waterways.

TABLE 2

ESTIMATED COSTS FOR BEST MANAGEMENT PRACTICES

LAKE CARMI WATERSHED, VERMONT

BMP's	UNIT	NUMBER	UNIT COST (3)	TOTAL COST
DIVERSIONS	feet	1,500	1.00	1,500.00
FILTER STRIPS	acre	2	140.00	280.00
DIVERSION TILE OUTLETS	feet	3,300	1.75	5,775.00
FIELD STRIPS	acres	433	25.00	10,825.00
PASTURE/HAYLAND PLANTING	acres	217	140.00	30,380.00
AERIAL SEEDING	acres	37	25.00	925.00
WASTE MANAGEMENT SYSTEM	No.	19	N/C	N/C
ANIMAL WASTE STORAGE STRUCTURE	No.	15	15,000.00 (1)	225,000.00
FIELD STORAGE STRUCTURE	No.	1	3,500.00	3,500.00
BARNYARD MANAGEMENT SYSTEM	No.	11	3,000.00 (2)	33,000.00
TOTAL				$311,185.00

(1) This unit price was calculated by adding all estimated costs for each structure and averaged.

(2) This BMP unit cost includes concrete exercise yards, underground drainage, eave troughs and diversions.

(3) Based on Vermont Average Cost Table, SCS, 1980 Figures.

APPENDIX A

BEST MANAGEMENT PRACTICES (BMP's)*

BMP	Purpose
Permanent Vegetative Cover	Improvement of water quality by establishing permanent vegetative cover on farmland to prevent excessive runoff of water or soil loss contributing to water pollution.
Animal Waste/Milkhouse Waste Control System	Improvement of water quality by providing facilities and management for the storage and handling of livestock waste and/or milkhouse waste to prevent or abate water pollution which will otherwise result from livestock operations.
Stripcropping	Improvement of water quality by providing enduring protection to cropland causing water pollution problems by establishment of contour or field stripcropping systems.
Terrace System	To improve water quality through the installation of terrace system on farmland to prevent excessive runoff of water or soil loss contributing to water pollution.
Diversion Systems	To improve water quality by installing diversions on farmland where excess surface or subsurface water runoff contributes to a water pollution problem.
Grazing Land Protective System	To improve water quality through better grazing distribution and better grassland management by developing spring seeps, wells, ponds or dugouts, installing pipelines and storage facilities. The practice is applicable only when needed to correct an existing problem causing water pollution due to over concentratio of livestock.
Waterway System	To improve water quality by installing a waterway to safely conv excess surface runoff water across fields at non-erosive velocities into watercourses or impoundments. The waterway is protected from erosion and reduces pollution through filtering out silt with the establishment of sod cover of perennial grasses and/or legumes.
Cropland Protective System	To improve water quality by providing needed protection from severe erosion on cropland between crops or pending establishment of enduring protective vegetative cover.
Conservation Tillage System	To improve water quality by the use of reduced tillage operations in producing a crop is the purpose of this BMP. The reduced tillage operations and crop residue management need to be performed annually.

APPENDIX A

BEST MANAGEMENT PRACTICES (BMP's)* (cont.)

BMP	Purpose
Stream Protection System	To improve water quality by protecting streams from sediment or chemicals through the installation of vegetative filter strips, protective fencing, livestock crossings, livestock water facilities, or other similar measures.
Permanent Vegetative Cover On Critical Areas	To improve water quality by installing measures to stabilize a source of sediment such as gullies, banks, privately owned roadsides, field borders, or similar problem areas contributing to water pollution.
Sediment Retention, Erosion	To improve water quality through the control of erosion, including sediment and chemical runoff, from a specific problem area thereby preventing water pollution.

APPENDIX B

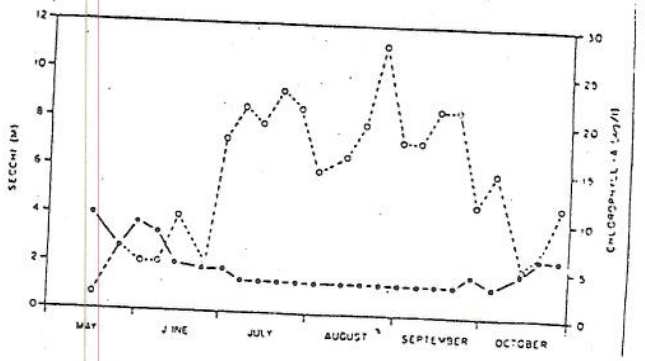
1979 MEAN SECCHI DISK DATA (M)

SECCHI	MAY	JUNE	JULY	AUG	SEPT	OCT	Summer Average June-Aug	Season Average May-Oct
STATION #1	3.9	2.5	1.1	1.0	1.1	2.0	1.5	1.6
STATION #2	3.7	2.5	1.1	1.0	1.1	2.0	1.5	1.6
LAKE	3.8	2.5	1.1	1.0	1.1	2.0	1.5	1.6

1979 MEAN CHLOROPHYLL-A DATA (ug/l)

CHLOROPHYLL-A	MAY	JUNE	JULY	AUG	SEPT	OCT	Summer Average June-Aug	Season Average May-Oct
STATION #1	4.2	6.6	24	20	18	9.7	17	15
STATION #2	4.2	6.1	19	19	18	9.2	15	14
LAKE	4.2	6.4	21	19	18	9.4	16	14

SECCHI (——) and CHLOROPHYLL-A (- - - -) vs TIME



Lake Carmi has a summer average Secchi disk transparency of 1.5 meters, based on data collected from June through August of 1979. When compared to the other participating lay monitoring lakes, the water clarity of Lake Carmi ranks as below average. The Secchi visibility in the lake fell from 4 meters in May to 1 meter in the beginning of July and remained at 1 meter throughout the summer until the end of September. The summer average chlorophyll-a concentration in the Lake Carmi is 16 micrograms per liter, based on data collected from June through August of 1979. When compared to other advanced lay monitoring lakes, the chlorophyll concentration in Lake Carmi ranks as higher than average. From July through October of 1979, large populations of algal growth persisted in the lake. The greatest peak in algal populations was observed during the last week of August when the chlorophyll concentration reached 28 micrograms per liter. The spring phosphorus concentration in Lake Carmi in 1979 was 18 micrograms per liter, which ranks as higher than average in comparison to the other lay monitoring lakes.

* 1979 Vermont Lay Monitoring Report - A.E.C.-D.W.R., Water Quality Surveillance Series Report No. 7-1980.

REFERENCES

(1) "Lake Carmi-Water Quality Report 1976", Report No. 11, Vermont Agency of Environmental Conservation, Department of Water Resources, page 19.

(2) "Lake Carmi-Water Quality Report 1976", Report No. 11, page 23.

(3) "An Application for Assistance for a Rural Clean Water Project: St. Albans Bay Watershed-Lake Carmi Watershed, Vermont-1979", Agency of Environmental Conservation, page 18.

(4) "An Application for Assistance...1979", A.E.C., page 19.

(5) "An Application for Assistance...1979", A.E.C., page 19.

(6) "A State Water Quality Plan for Controlling Agricultural Pollution".- State of Vermont, Agency of Environmental Conservation, August 2, 1978.

(7) "Lake Carmi-Water Quality Report 1976", Report No. 11, page 5.

(8) "Lake Carmi-Water Quality Report 1976", Report No. 11, page 5.

(9) "Lake Carmi-Water Quality Report 1976", Report No. 11, page 23.

(10) "Lake Carmi-Water Quality Report 1976", Report No. 11, page 19.

(11) "An Application for Assistance...1979", A.E.C., page 19.

(12) "Lake Carmi-Water Quality Report 1976", Report No. 11, page 52.

(13) "Predicting Rainfall Erosion Losses - A Guide to Conservation Planning", U.S.D.A. Handbook 537.

Appendix B

Vermont Livestock Waste Management Educational Program

Appendix B

STATUS OF

VERMONT LIVESTOCK WASTE MANAGEMENT

EDUCATIONAL PROGRAM

As of April 15, 1981

The following is referring to the "Strategy and Rationale of the Vermont Livestock Waste Management Educational Program Extension Service, University of Vermont," dated January 7, 1981 and specifically addresses the items under the Plan of Action section:

To date, we have gathered a wealth of information and slides to be used in conducting community meetings. There has also been at least one meeting with all county extension agents, that are located in counties where the top ranked problem watersheds are. There were planning meetings for community meetings and in some cases, instruction was given to the agent.

Unfortunately, due to the very unusual winter and spring that Vermont experienced this year, agents did not schedule many meetings for spring because farmers are too busy. However, they did schedule four meetings in the summer and fall.

The following is a list of meetings scheduled in top ranked watershed areas:

Addison County - will have two fall meetings, date and location not finalized.

Chittenden County - will have three late summer or fall meetings, date and location not finalized.

Franklin County - will have at least two meetings. The first will be April 30, 12:30 p.m. - 4:00 p.m. in St. Albans. The others will be in the summer.

Lamoille County - is planning two meetings, the first will be May 27 in Morrisville, the other will be later in the summer.

Orleans County - is planning to have three meetings in August.

Rutland County - feels they have done enough with livestock waste and will not have meetings.

Washington County - is planning on having one meeting in early September in East Montpelier.

As far as scheduling meetings in the other part of the state, due to the weather we had similar difficulties. They are as follows:

Bennington County - will have a meeting April 20 at 1:00 p.m. in Bennington.

Caledonia County - will be having two meetings in August; the reason for this date is we have set up some test plots there.

Essex County - will have two meetings in August or September.

Grand Isle County - will have a meeting in June, date and location not set.

Orange County - will have a meeting in Randolph and Bradford in August.

Windham County - will have one meeting in September.

Windsor County - will have one meeting in Woodstock.

The other parts of our program are on schedule and are doing quite well.

The status of statewide activities are as follows:

A. I have had many questions referred to me from throughout the state. I have also talked to each agent individually at least once. I have gathered information for each agent for a Livestock Waste reference notebook.

B. I have written two articles and three fact sheets for County Extension Agents.

C. I have done one radio show statewide.

D. I have produced four news releases.

E. The "Manure Guide" by Win Way is under production.

F. Both publications on manure storage odor problems are finished and are being edited for publication.

G. Made corrections and suggestions to the NRAES and NDPC manure publication committee, which will be incorporated into the manure guides next printing.

H. Comparison sheet of itemized costs of different systems is now in a rough draft.

I. We were planning on presenting programs in the fall to the state Vocational Agricultural students throughout the state. However, due to the problem in scheduling spring community meetings, we are trying to schedule these school talks now.

J. Presently, we have taken approximately 400 slides to be used in single concept slide shows and to be used in county shows.

To date this is what has been done.

Appendix C

Guidelines for the Utilization and Disposal of Municipal Wastewater Sludge

Appendix C

GUIDELINES FOR THE UTILIZATION AND DISPOSAL OF MUNICIPAL WASTEWATER SLUDGE

VERMONT AGENCY OF ENVIRONMENTAL CONSERVATION

FEBRUARY 1981

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